Analysis of survey data for metrics, scientific literacy and attitude

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Load data.

```
#First, please change your working directory to the current one.
# On Mac, "Session"->"Setting working directory" -> "Source file location"
# On Windows, "Tools"->"Setting working directory" ->"To Source file location".

setwd("~/github/metric-proficiency--scientific-literacy-and-attitude/2017")

# You can see files in the current working directory
list.files()
```

```
## [1] "metric_responses20171019.csv" "metric_v2.R"
## [3] "metric.html"                  "metric.pdf"
## [5] "metric.Rmd"
```

```
#Read the survey data in csv format
# colClass specify that all columns will be treated as characters for now.
tb.ori = read.csv("metric_responses20171019.csv", colClass=rep("character", 24))
#str
#str(tb.ori);
#tb.ori$Timestamp

tb = tb.ori  #make a copy because we will modify the table.
```

```
names(tb.ori)
```

```
##  [1] "Timestamp"
##  [2] "Please.indicate.your.gender"
##  [3] "Please.indicate.your.age.category"
##  [4] "What.is.the.highest.education.that.you.received.or.are.currently.pursing."
##  [5] "Please.indicate.the.country.in.which.you.grew.up."
##  [6] "Light.is.both.a.wave.and.a.particle"
##  [7] "A.man.is.2.16.meters.tall..Is.this.person.suited.to.be.a.good.professional.basketball.player."
##  [8] "A.30.year.old.scientist.found.a.6.million.year.old.fossil..When.this.scientist.becomes.35.years
##  [9] "X.Kilo..means"
## [10] "X145.mm..___.m"
## [11] "Do.you.agree.that.organic.food.should.be.DNA.free.food."
## [12] "A.person.s.pant.inseam.measures.35.centimeters."
## [13] "The.weather.forecast.shows.a.high.of.32.degrees.Celcius..what.should.you.wear."
## [14] "What.is.an.electron.attracted.to."
## [15] "Early.human.once.lived.with.dinosaurs."
## [16] "Lasers.work.by.focusing.sound.waves"
## [17] "The.continents.have.been.moving.their.location.for.millions.of.years.and.will.continue.to.move
## [18] "Antibiotics.kills.viruses.as.well.as.bacteria."
## [19] "Electrons.are.smaller.than.atoms"
## [20] "The.center.of.the.earth.is.very.hot."
## [21] "My.religious.views.are.more.important.than.scientific.views."
```

```
## [22] "For.me..in.my.daily.life..it.is.not.important.to.know.about.science."
## [23] "Science.and.technology.are.making.our.lives.healthier..easier.and.more.comfortable."
## [24] "The.benefits.of.science.are.greater.than.any.harmful.effects.it.may.have."
```

```
?names
#rename the columns with shortter names for convenience
names(tb) = c("time","gender", "age", "degree", "country", "light", "shaq", "fossil", "kilo", "mm",
        "food","inseam", "weather","electronCharge","earlyHuman",
        "laser", "continents", "antibiotics", "electronSize","earthCenter",
        "religiousView","dailyLife","SciOnLife", "SciEffect")
str(tb)
```

```
## 'data.frame':    468 obs. of  24 variables:
##  $ time          : chr  "3/5/2013 14:34:19" "3/5/2013 14:47:37" "3/5/2013 14:53:48" "3/5/2013 15:01:3
##  $ gender        : chr  "Do not wish to answer" "Male" "Female" "Do not wish to answer" ...
##  $ age           : chr  "18-22" "18-22" "31-40" NA ...
##  $ degree        : chr  "Bachelor Degree in Science or equivalent" "High School or equivalent" "High
##  $ country       : chr  "United States" "United States" "United States" "United States" ...
##  $ light         : chr  "TRUE" "TRUE" "TRUE" "Wrong" ...
##  $ shaq          : chr  "Yes" "No" "No" "Yes" ...
##  $ fossil        : chr  "6 million and 5 years old" "6 million and 5 years old" "6 million and 5 yea
##  $ kilo          : chr  "1000 x" "1000 x" "100 x" "1000 x" ...
##  $ mm            : chr  "0.145" "0.145" "1.45" "0.145" ...
##  $ food          : chr  "I don't know" "Dis-agree" "Dis-agree" "Dis-agree" ...
##  $ inseam        : chr  "This person is tall" "This person is short" "This person is short" "This pe
##  $ weather       : chr  "A winter coat" "A Short sleeve shirt" "A light jacket" "A winter coat" ...
##  $ electronCharge: chr  "Negative charge" "Positive charge" "Positive charge" "Positive charge" ...
##  $ earlyHuman    : chr  "FALSE" "FALSE" "TRUE" "FALSE" ...
##  $ laser         : chr  "TRUE" "FALSE" "FALSE" "FALSE" ...
##  $ continents    : chr  "TRUE" "TRUE" "TRUE" "TRUE" ...
##  $ antibiotics   : chr  "FALSE" "FALSE" "FALSE" "FALSE" ...
##  $ electronSize  : chr  "True " "True " "True " "True " ...
##  $ earthCenter   : chr  "TRUE" "TRUE" "TRUE" "TRUE" ...
##  $ religiousView : chr  "Yes" "Yes" "Yes" "No" ...
##  $ dailyLife     : chr  "FALSE" "FALSE" "Neutral" "FALSE" ...
##  $ SciOnLife     : chr  "TRUE" "TRUE" "TRUE" "TRUE" ...
##  $ SciEffect     : chr  "TRUE" "TRUE" "FALSE" "Not sure" ...
```

```
#visual check of the renaming.
# cbind is to combine columns.
# substr is to take a portion of string variables.
cbind (names(tb), substr(names(tb.ori), 1, 20))
```

```
##       [,1]            [,2]
##  [1,] "time"          "Timestamp"
##  [2,] "gender"        "Please.indicate.your"
##  [3,] "age"           "Please.indicate.your"
##  [4,] "degree"        "What.is.the.highest."
##  [5,] "country"       "Please.indicate.the."
##  [6,] "light"         "Light.is.both.a.wave"
##  [7,] "shaq"          "A.man.is.2.16.meters"
##  [8,] "fossil"        "A.30.year.old.scient"
##  [9,] "kilo"          "X.Kilo..means"
## [10,] "mm"            "X145.mm..._____.m"
## [11,] "food"          "Do.you.agree.that.or"
## [12,] "inseam"        "A.person.s.pant.inse"
```

```
## [13,] "weather"        "The.weather.forecast"
## [14,] "electronCharge" "What.is.an.electron."
## [15,] "earlyHuman"     "Early.human.once.liv"
## [16,] "laser"          "Lasers.work.by.focus"
## [17,] "continents"     "The.continents.have."
## [18,] "antibiotics"    "Antibiotics.kills.vi"
## [19,] "electronSize"   "Electrons.are.smalle"
## [20,] "earthCenter"    "The.center.of.the.ea"
## [21,] "religiousView"  "My.religious.views.a"
## [22,] "dailyLife"      "For.me..in.my.daily."
## [23,] "SciOnLife"      "Science.and.technolo"
## [24,] "SciEffect"      "The.benefits.of.scie"
```

```
?cbind

tb[1:5, 2:3]
```

```
##                   gender   age
## 1 Do not wish to answer 18-22
## 2                   Male 18-22
## 3                 Female 31-40
## 4 Do not wish to answer  <NA>
## 5                 Female 51-55
```

```
#correct some input errors
# If there is no input of 'age'
tb$age[is.na(tb$age)] = 'Do not wish to answer'
table(tb$age)
```

```
##
##                  18-22                  23-30                  31-40
##                    285                     42                     43
##                  41-50                  51-55                  56-60
##                     30                     20                     18
##  Do not wish to answer More than 60 years old
##                      2                     28
```

```
?table
# If there is no input of 'gender'

tb$degree [is.na(tb$degree)] = 'Do not wish to answer'
table(tb$degree)
```

```
##
##    Bachelor Degree in Arts or equivalent
##                                       58
## Bachelor Degree in Science or equivalent
##                                      195
##                High School or equivalent
##                                      109
##                       M.D. or equivalent
##                                        6
##              Master Degree or equivalent
##                                       39
##                       Ph.D. or equivalent
##                                       61
```

```r
tb$gender[tb$gender=='']='Do not wish to answer'
table(tb$gender)
```

```
##
## Do not wish to answer               Female                 Male
##                     6                  345                  117
```

```r
debug = 0;
# dealing with missing values, add 'NA' to empty answers
# nested for-loops
for( i in 5:length(tb[, 1])) {  #outter for-loop
  for( j in 5:length(tb[1, ])) {  #inner for-loop
    if (debug > 0) { print( paste("i=", i, "j=", j) ) }
  }
}

for( i in 5:length(tb[, 1])) {  #outter for-loop
  for( j in 5:length(tb[1, ])) {  #inner for-loop
    if ( is.na(tb[i, j]) ) {
      # do nothing
    } else if (tb[i,j]=='') {
      tb[i,j] = NA
    }
  }
}
```

```r
##### create a second table, convert character values to numerical values
tb2 = tb[,c(2,4,5)]  #this is the score table
head(tb2)
```

```
##                  gender                                    degree
## 1 Do not wish to answer Bachelor Degree in Science or equivalent
## 2                  Male                High School or equivalent
## 3                Female                High School or equivalent
## 4 Do not wish to answer Bachelor Degree in Science or equivalent
## 5                Female                High School or equivalent
## 6                Female    Bachelor Degree in Arts or equivalent
##         country
## 1 United States
## 2 United States
## 3 United States
## 4 United States
## 5 United States
## 6 United States
```

```r
#calculate the average age for each category

?grep
tb2$age = NA
tb2$age[grep("18-22", tb$age)] = 18/2 + 22/2
tb2$age[grep("23-30", tb$age)] = 23/2 + 30/2
```

```r
tb2$age[grep("31-40", tb$age)] = 31/2 + 40/2
tb2$age[grep("41-50", tb$age)] = 41/2 + 50/2
tb2$age[grep("51-55", tb$age)] = 51/2 + 55/2
tb2$age[grep("56-60", tb$age)] = 56/2 + 60/2
tb2$age[grep("More than 60 years", tb$age)] = 65
table(tb$age)
```

```
##
##                  18-22                  23-30                  31-40
##                    285                     42                     43
##                  41-50                  51-55                  56-60
##                     30                     20                     18
##  Do not wish to answer More than 60 years old
##                      2                     28
```

```r
table(tb2$age)
```

```
##
##   20 26.5 35.5 45.5   53   58   65
##  285   42   43   30   20   18   28
```

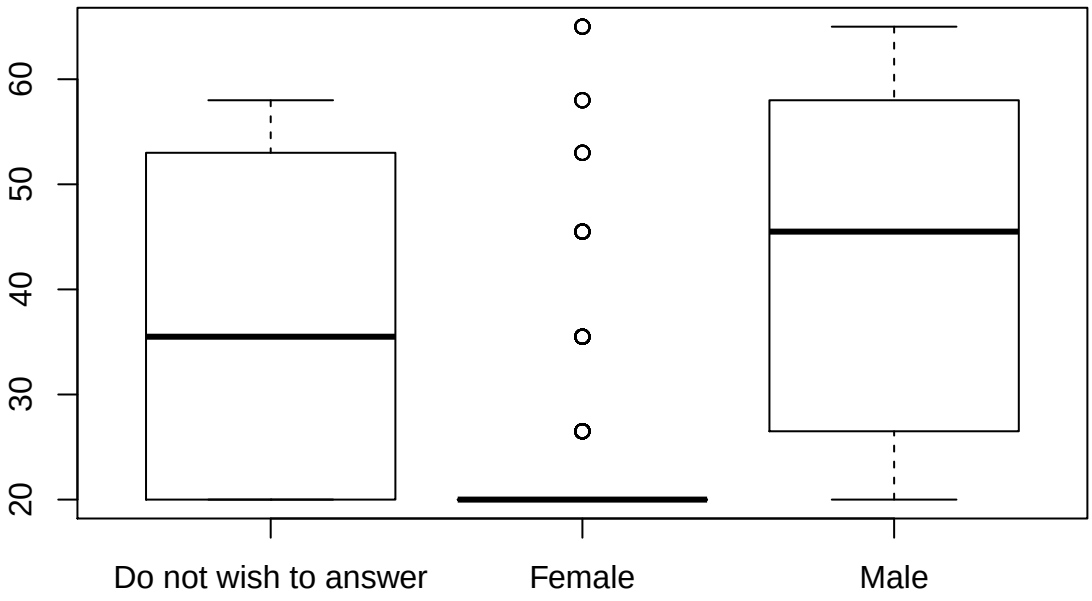
```r
summary(tb2$age)
```

```
##    Min. 1st Qu.  Median    Mean 3rd Qu.    Max.    NA's
##   20.00   20.00   20.00   29.25   35.50   65.00       2
```

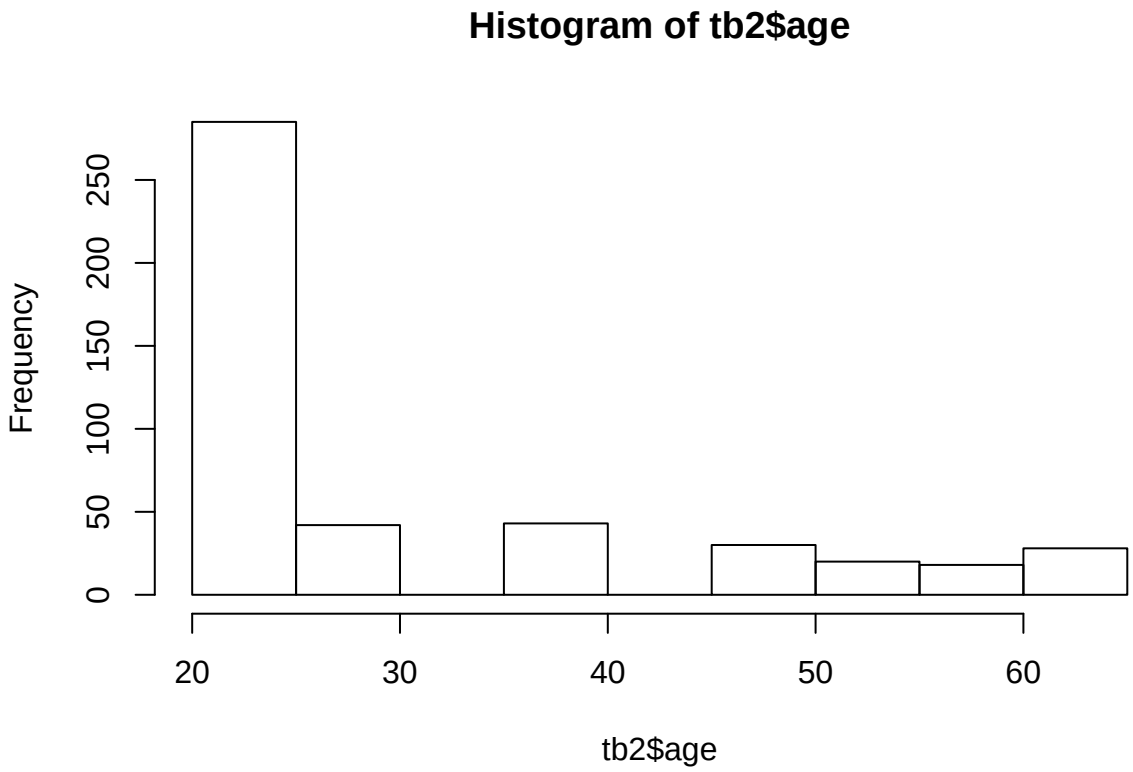
```r
#Visualize the data
table(tb2$age, tb2$gender)
```

```
##
##        Do not wish to answer Female Male
##   20                       2    263   20
##   26.5                     0     26   16
##   35.5                     1     24   18
##   45.5                     0     14   16
##   53                       1      6   13
##   58                       1      5   12
##   65                       0      7   21
```

```r
boxplot( tb2$age ~ tb2$gender)
```




```
#histogram of age
hist(tb2$age)
```




```
###country
table( tb$country )  #All the inputed 'countries'
```

```
##
##           Armenia         Australia           Bahamas
##                 1                 5                 2
##            Canada             China           Croatia
##                 3                 4                 1
```

```
##            Estonia           Ethiopia             France
##                  1                  1                  1
##            Germany              Ghana             Guyana
##                  2                  1                  1
##              India            Jamaica              Kenya
##                  3                  3                  2
##            Lebanon             Mexico        New Zealand
##                  1                  1                  1
##            Nigeria             Norway             Poland
##                  2                  1                  3
## Russian Federation             Rwanda            Senegal
##                  2                  2                  1
##       South Africa              Syria             Taiwan
##                  3                  1                  1
##  Trinidad & Tobago     United Kingdom      United States
##                  3                 10                402
```

```
tb2$country = 0  #for non-USA countries
tb2$country[tb$country=='United States'] = 1
table( tb2$country )
```

```
##
##   0   1
##  66 402
```

```
#have a look at some entries
head(tb2)
```

```
##                  gender                                    degree country
## 1 Do not wish to answer Bachelor Degree in Science or equivalent       1
## 2                  Male               High School or equivalent       1
## 3                Female               High School or equivalent       1
## 4 Do not wish to answer Bachelor Degree in Science or equivalent       1
## 5                Female               High School or equivalent       1
## 6                Female    Bachelor Degree in Arts or equivalent       1
##    age
## 1 20.0
## 2 20.0
## 3 35.5
## 4   NA
## 5 53.0
## 6 58.0
```

```
#double-check the columns
names(tb2)
```

```
## [1] "gender"  "degree"  "country" "age"
```

```
######################
# The survey contains by 3 categories of questions
# 1) Metric proficiency
# 2) Scientific literacy
# 3) Attitude toward science
# We will calculate the score of each categoriy separately and then apply regressions.

### Here are the columns for the 3 categories
metrics = c("shaq", "kilo", "mm", "inseam", "weather")
```

```
sciLiteracy = c("light", "fossil", "food", "electronCharge",
                "earlyHuman", "laser", "continents", "antibiotics",
                "electronSize", "earthCenter")
sciAttitude = c("religiousView", "dailyLife", "SciOnLife", "SciEffect")

########calculate the metric scores
tb2$shaq = 0.5
tb2$shaq[ tb$shaq=='Yes' ] = 1
tb2$shaq[ tb$shaq=='No' ] = 0
table(tb2$shaq)
```

```
##
##   0 0.5   1
##  73  85 310
```

```
tb2$kilo = 0
tb2$kilo[ tb$kilo=='1000 x' ] = 1
table(tb2$kilo)
```

```
##
##   0   1
##  48 420
```

```
tb2$mm=0
tb2$mm[ tb$mm==0.145 ] = 1
table(tb2$mm)
```

```
##
##   0   1
## 189 279
```

```
table(tb$mm)
```

```
##
##          0.0145           0.145            1.45         145,000
##              55             279             108               3
##          145000 I do not know.
##              12               8
```

```
tb2$inseam = 0.5
tb2$inseam[tb$inseam=="This person is short"] = 1
tb2$inseam[tb$inseam=="This person is tall"] = 0
table(tb2$inseam)
```

```
##
##   0 0.5   1
##  71  92 305
```

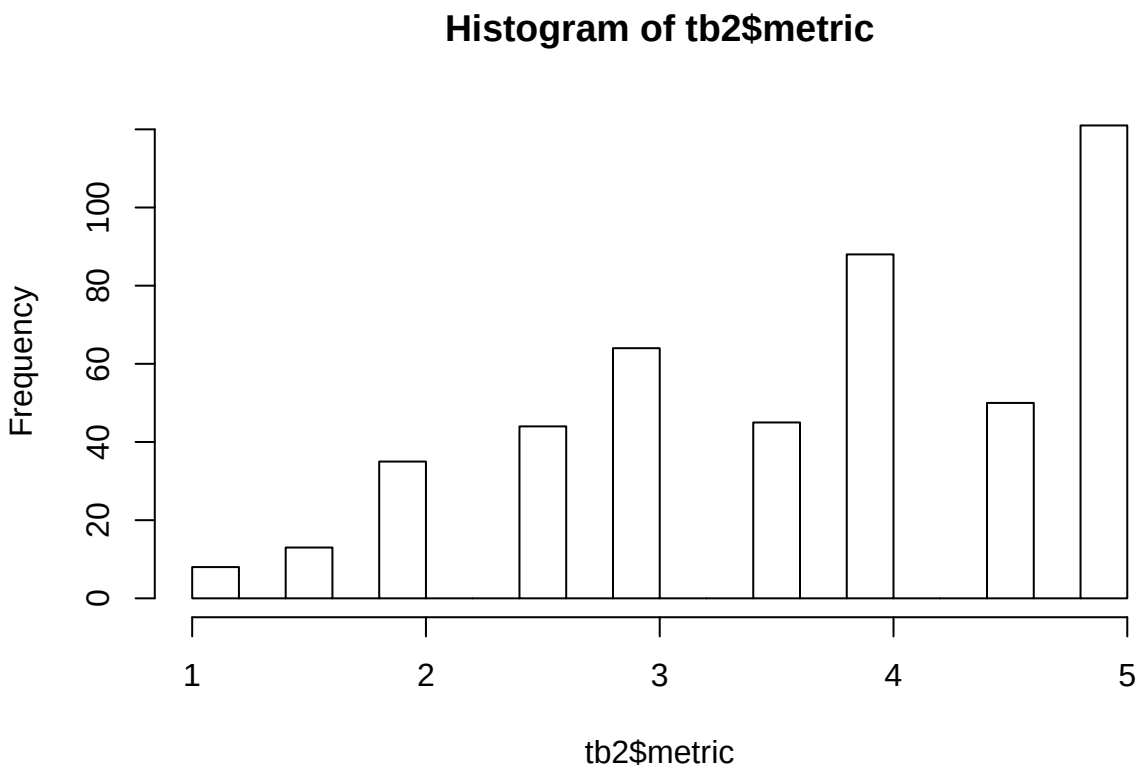
```
tb2$weather = 0.5
tb2$weather[tb$weather=="A Short sleeve shirt"] = 1
tb2$weather[tb$weather=="A winter coat"] = 0
table(tb$weather)
```

```
##
##       A light jacket A Short sleeve shirt        A winter coat
##                   80                  272                   67
##         I don't know
##                   44
```

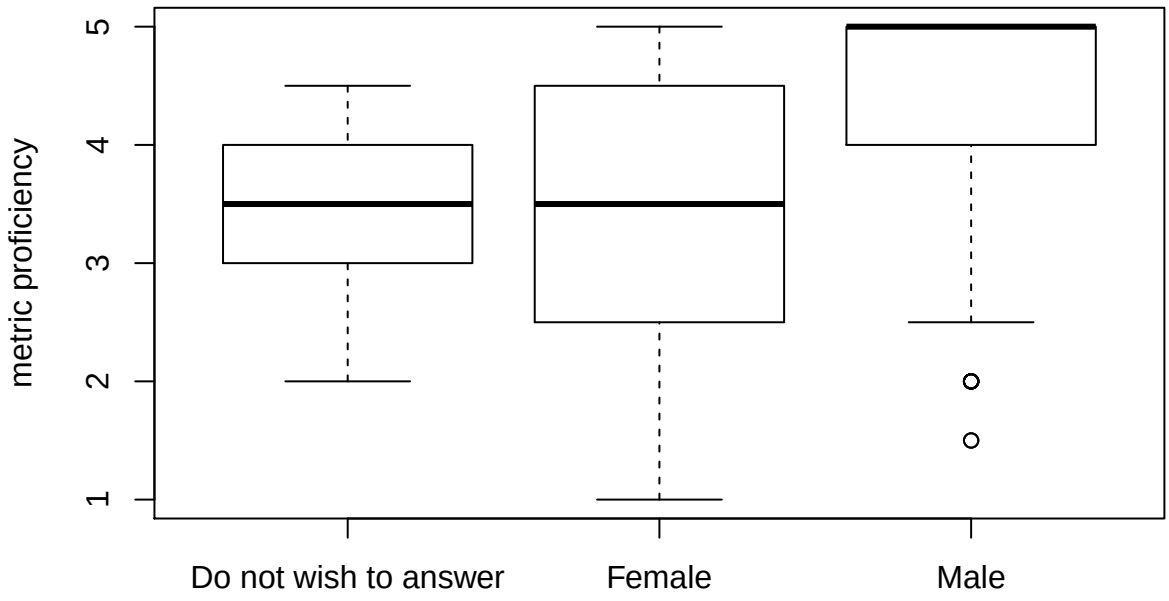
```r
table(tb2$weather)
```

```
##
##   0 0.5   1
##  67 129 272
```

```r
######### summarize the metric proficiency score
#metrics = c("shaq", "kilo", "mm", "inseam", "weather")
#metric total score
tb2$metric = apply( tb2[, metrics], MARGIN=1, FUN=sum )
hist(tb2$metric, br=20)
```



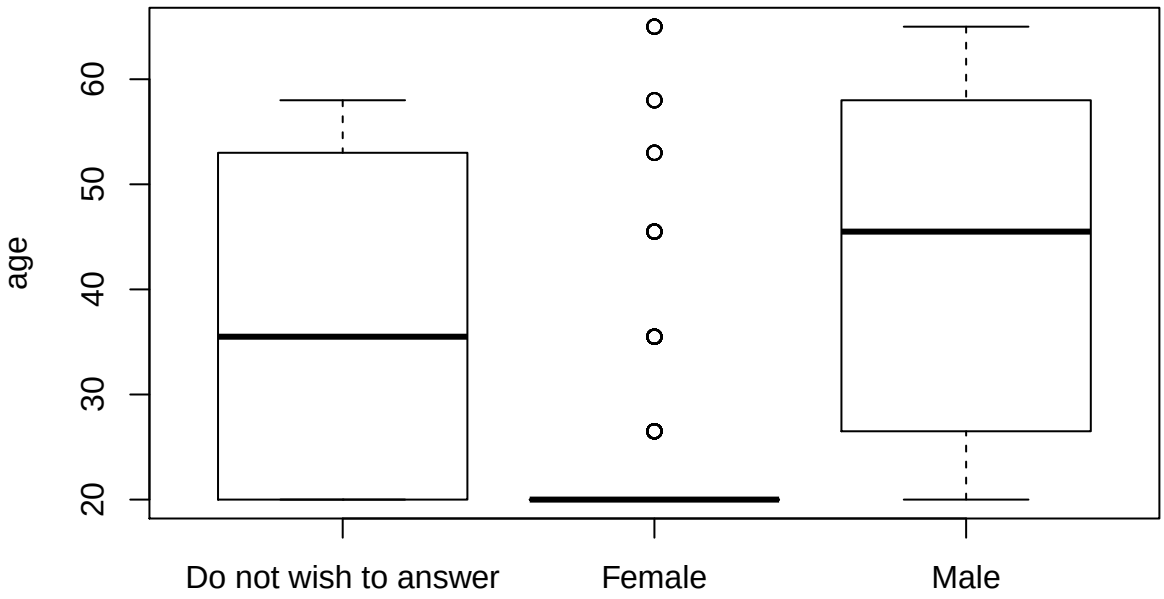

```r
#Do females tend to be less profient in metric usage?
boxplot( tb2$metric ~ tb2$gender, ylab="metric proficiency" )
```




```r
t.test(tb2$metric[tb2$gender=='Female'], tb2$metric[tb2$gender=='Male'])
```

```
##
##  Welch Two Sample t-test
##
## data:  tb2$metric[tb2$gender == "Female"] and tb2$metric[tb2$gender == "Male"]
## t = -6.4303, df = 217.98, p-value = 7.933e-10
## alternative hypothesis: true difference in means is not equal to 0
## 95 percent confidence interval:
##  -0.9091133 -0.4825627
## sample estimates:
## mean of x mean of y
##  3.543478  4.239316
```

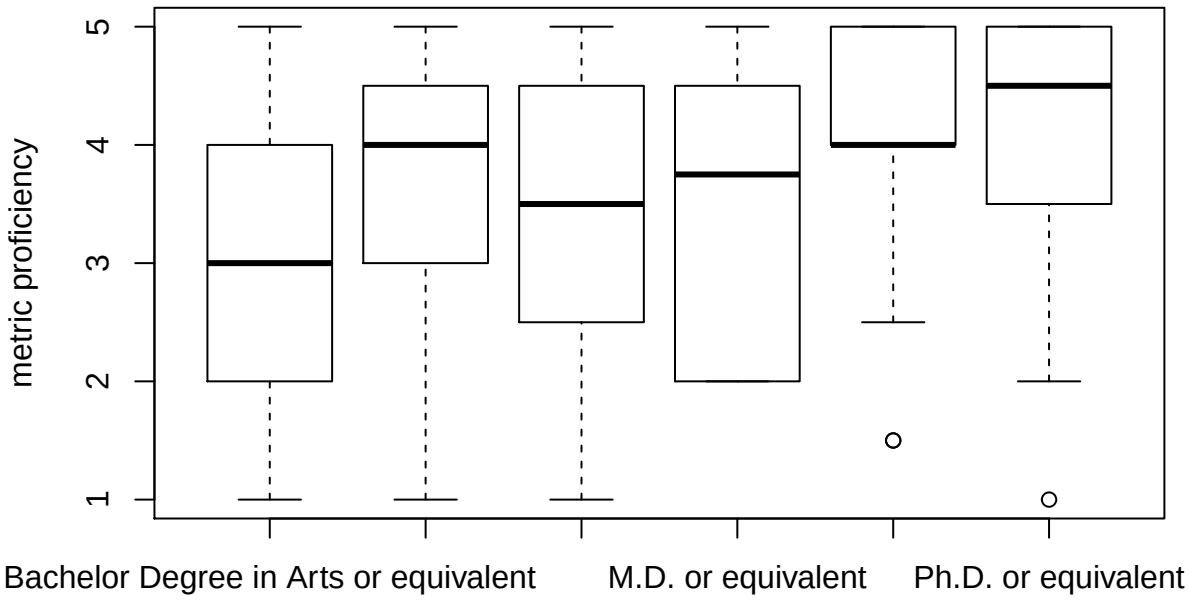
```r
#Does this mean that females are more uncomfortable with metric usage?

# Female participants tend to be younger
boxplot( tb2$age ~ tb2$gender, ylab='age')
```




```
# More female participants with Bachelor degrees
table( tb2$gender, tb2$degree )
```

```
##
##                         Bachelor Degree in Arts or equivalent
##   Do not wish to answer                                     0
##   Female                                                   41
##   Male                                                     17
##
##                         Bachelor Degree in Science or equivalent
##   Do not wish to answer                                       2
##   Female                                                    165
##   Male                                                       28
##
##                         High School or equivalent M.D. or equivalent
##   Do not wish to answer                         1                 0
##   Female                                       82                 4
##   Male                                         26                 2
##
##                         Master Degree or equivalent Ph.D. or equivalent
##   Do not wish to answer                           0                   3
##   Female                                         18                  35
##   Male                                           21                  23
```

```
boxplot( tb2$metric ~ tb2$degree, ylab='metric proficiency')
```




```
# Multiple regression
m1 = lm( tb2$metric ~ tb2$degree )
summary(m1)
```

```
##
## Call:
## lm(formula = tb2$metric ~ tb2$degree)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -3.1475 -0.7974  0.2026  0.8525  1.8621
##
## Coefficients:
##                                                  Estimate Std. Error
## (Intercept)                                        3.1379     0.1393
## tb2$degreeBachelor Degree in Science or equivalent   0.6595     0.1586
## tb2$degreeHigh School or equivalent                0.3667     0.1724
## tb2$degreeM.D. or equivalent                       0.3621     0.4549
## tb2$degreeMaster Degree or equivalent              0.9775     0.2197
## tb2$degreePh.D. or equivalent                      1.0096     0.1945
##                                                  t value Pr(>|t|)
## (Intercept)                                       22.530  < 2e-16 ***
## tb2$degreeBachelor Degree in Science or equivalent   4.157 3.84e-05 ***
## tb2$degreeHigh School or equivalent                2.127    0.034 *
## tb2$degreeM.D. or equivalent                       0.796    0.426
## tb2$degreeMaster Degree or equivalent              4.450 1.08e-05 ***
## tb2$degreePh.D. or equivalent                      5.190 3.16e-07 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1.061 on 462 degrees of freedom
## Multiple R-squared:  0.07707,    Adjusted R-squared:  0.06708
## F-statistic: 7.716 on 5 and 462 DF,  p-value: 5.528e-07
```

```r
m2 = lm( tb2$metric ~ tb2$age )
summary(m2)
```

```
##
## Call:
## lm(formula = tb2$metric ~ tb2$age)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -3.2702 -0.6777  0.2068  0.9223  1.4223
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept) 3.269856   0.112828  28.981  < 2e-16 ***
## tb2$age     0.015390   0.003462   4.445  1.1e-05 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1.074 on 464 degrees of freedom
##   (2 observations deleted due to missingness)
## Multiple R-squared:  0.04084,    Adjusted R-squared:  0.03877
## F-statistic: 19.76 on 1 and 464 DF,  p-value: 1.101e-05
```

```r
m3 = lm( tb2$metric~ tb2$gender + tb2$degree + tb2$age )
summary(m3)
```

```
##
## Call:
## lm(formula = tb2$metric ~ tb2$gender + tb2$degree + tb2$age)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -2.9665 -0.6944  0.1684  0.8056  2.0416
##
## Coefficients:
##                                                  Estimate Std. Error
## (Intercept)                                      2.450074   0.501471
## tb2$genderFemale                                 0.463232   0.465484
## tb2$genderMale                                   1.136856   0.471322
## tb2$degreeBachelor Degree in Science or equivalent 0.735983   0.155064
## tb2$degreeHigh School or equivalent              0.373213   0.166718
## tb2$degreeM.D. or equivalent                     0.288506   0.437704
## tb2$degreeMaster Degree or equivalent            0.739784   0.220346
## tb2$degreePh.D. or equivalent                    0.906657   0.197634
## tb2$age                                          0.002254   0.004458
##                                                  t value Pr(>|t|)
## (Intercept)                                        4.886 1.43e-06 ***
## tb2$genderFemale                                   0.995 0.320183
## tb2$genderMale                                     2.412 0.016256 *
## tb2$degreeBachelor Degree in Science or equivalent   4.746 2.78e-06 ***
## tb2$degreeHigh School or equivalent                2.239 0.025664 *
## tb2$degreeM.D. or equivalent                       0.659 0.510142
## tb2$degreeMaster Degree or equivalent              3.357 0.000853 ***
## tb2$degreePh.D. or equivalent                      4.588 5.80e-06 ***
```

```
## tb2$age                                                0.506 0.613266
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1.019 on 457 degrees of freedom
##   (2 observations deleted due to missingness)
## Multiple R-squared:  0.1497, Adjusted R-squared:  0.1348
## F-statistic: 10.06 on 8 and 457 DF,  p-value: 5.948e-13
```

```
#######calcualte the science attitude scores
#sciAttitude = c("religiousView", "dailyLife", "SciOnLife", "SciEffect")
# "My religious views are more important than scientific views
tb2$religiousView = 0.5
tb2$religiousView[grep("No", tb$religiousView)] = 1
tb2$religiousView[grep("Yes", tb$religiousView)] = 0
table(tb2$religiousView)
```

```
##
##   0 0.5   1
## 211  61 196
```

```
table(tb$religiousView)
```

```
##
## I do not know            No           Yes
##            55           196           211
```

```
# "For me, in my daily life, it is not important to know about science"
tb2$dailyLife = 0.5
tb2$dailyLife[ tb$dailyLife=='TRUE' ] = 0
tb2$dailyLife[ tb$dailyLife=='FALSE' ] = 1
table(tb2$dailyLife)
```

```
##
##   0 0.5   1
##  62  73 333
```

```
# "Science and technology are making our lives healthiers, easiers and more comfortable."
tb2$SciOnLife = 0.5
tb2$SciOnLife[ tb$SciOnLife=='TRUE' ] = 1
tb2$SciOnLife[ tb$SciOnLife=='FALSE' ] = 0
table(tb2$SciOnLife)
```

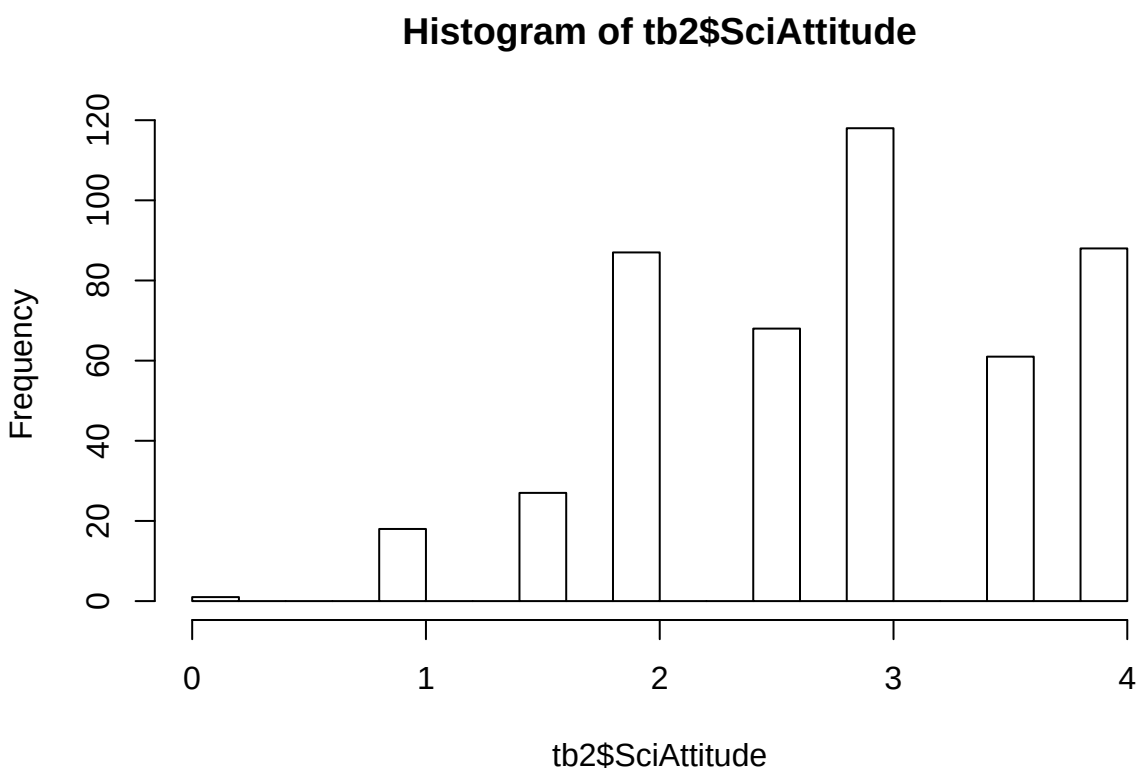
```
##
##   0 0.5   1
##  25  55 388
```

```
# "The benefits of sciences are greaters than any harmful effects that it may have."
tb2$SciEffect = 0.5
tb2$SciEffect[ tb$SciEffect=='TRUE' ] = 1
tb2$SciEffect[ tb$SciEffect=='FALSE' ] = 0
table( tb2$SciEffect )
```

```
##
##   0 0.5   1
##  84 147 237
```

```
#sciAttitude = c("religiousView", "dailyLife", "SciOnLife", "SciEffect")
#Attitude total score
```

```
tb2$SciAttitude = apply( tb2[, sciAttitude], MARGIN=1, FUN=sum)
hist(tb2$SciAttitude, br=20)
```




```
############calculate scientific literacy
#sciLiteracy = c("light", "fossil", "food", "electronCharge",
#                "earlyHuman", "laser", "continents", "antibiotics", "electronSize", "earthCenter")
tb2$light = 0.5
tb2$light[ tb$light=='TRUE' ] =1
tb2$light[ tb$light=='Wrong' ] =0
table(tb$light)
```

```
##
## I don't know.          TRUE         Wrong
##            43           353            68
```

```
table(tb2$light)
```

```
##
##   0 0.5   1
##  68  47 353
```

```
tb2$fossil = 0.5
tb2$fossil[ tb$fossil=='6 million and 5 years old' ] = 0
tb2$fossil[grep('Still', tb$fossil)] = 1;
table(tb$fossil)
```

```
##
##        6 million and 5 years old                      I don't know
##                              181                                37
## Still about 6 million years old.
##                              243
```

```
table(tb2$fossil)
```

```
##
##   0 0.5   1
## 181  44 243
```

```
tb2$food = 0.5
tb2$food[ tb$food=='Dis-agree' ] = 1
tb2$food[grep('Agree', tb$food)] = 0;
table(tb$food)
```

```
##
##        Agree    Dis-agree I don't know
##           81          257          128
```

```
table(tb2$food)
```

```
##
##   0 0.5   1
##  81 130 257
```

```
tb2$electronCharge = 0
tb2$electronCharge[grep('Positive', tb$electronCharge)] = 1;
table(tb$electronCharge)
```

```
##
##    Electricity   I do not know. Negative charge         Neutron
##              15               5              76              38
## Positive charge
##             331
```

```
table(tb2$electronCharge)
```

```
##
##   0   1
## 137 331
```

```
tb2$earlyHuman = 0.5
tb2$earlyHuman[grep('TRUE', tb$earlyHuman)] = 0;
tb2$earlyHuman[grep('FALSE', tb$earlyHuman)] = 1;
table(tb$earlyHuman)
```

```
##
##          FALSE I do not know.           TRUE
##            328             60             76
```

```
table(tb2$earlyHuman)
```

```
##
##   0 0.5   1
##  76  64 328
```

```
tb2$earlyHuman = 0.5
tb2$earlyHuman[grep('TRUE', tb$earlyHuman)] = 0;
tb2$earlyHuman[grep('FALSE', tb$earlyHuman)] = 1;
table(tb$earlyHuman)
```

```
##
##          FALSE I do not know.           TRUE
```

```
##            328             60             76
```

```
table(tb2$earlyHuman)
```

```
##
##   0 0.5   1
##  76  64 328
```

```
tb2$laser = 0.5
tb2$laser[grep('TRUE', tb$laser)] = 0;
tb2$laser[grep('FALSE', tb$laser)] = 1;
table(tb$laser)
```

```
##
##           FALSE I do not know.             TRUE
##             274             115              76
```

```
table(tb2$laser)
```

```
##
##   0 0.5   1
##  76 118 274
```

```
tb2$continents = 0.5
tb2$continents[grep('TRUE', tb$continents)] = 1;
tb2$continents[grep('FALSE', tb$continents)] = 0;
table(tb$continents)
```

```
##
##           FALSE I do not know.             TRUE
##              24              26             413
```

```
table(tb2$continents)
```

```
##
##   0 0.5   1
##  24  31 413
```

```
tb2$antibiotics = 0.5
tb2$antibiotics[grep('TRUE', tb$antibiotics)] = 0;
tb2$antibiotics[grep('FALSE', tb$antibiotics)] = 1;
table(tb$antibiotics)
```

```
##
##          FALSE I do not know.           TRUE
##            316             29            122
```

```
table(tb2$antibiotics)
```

```
##
##   0 0.5   1
## 122  30 316
```

```
tb2$electronSize = 0.5
tb2$electronSize[grep('True', tb$electronSize)] = 1;
tb2$electronSize[grep('FALSE', tb$electronSize)] = 0;
table(tb$electronSize)
```

```
##
##          FALSE I do no know.           True
##            105             37            320
```

```
table(tb2$electronSize)
```

```
##
##   0 0.5   1
## 105  43 320
```

```
tb2$earthCenter = 0.5
tb2$earthCenter[grep('TRUE', tb$earthCenter)] = 1;
tb2$earthCenter[grep('FALSE', tb$earthCenter)] = 0;
table(tb$earthCenter)
```

```
##
##          FALSE I do not know.           TRUE
##             25             26            413
```

```
table(tb2$earthCenter)
```

```
##
##   0 0.5   1
##  25  30 413
```

```
#sciLiteracy = c("light", "fossil", "food", "electronCharge",
#                "earlyHuman", "laser", "continents", "antibiotics", "electronSize", "earthCenter")

tb2$SciLitScore = apply( tb2[, sciLiteracy], MARGIN=1, FUN=sum ) #by row
hist(tb2$SciLitScore, br=20)
```


```
##########################
## regression analyses
#summary(tb); str(tb)

#remove rows with missing age from analysis. Missing age can cause bugs in anova model comparisons.
```

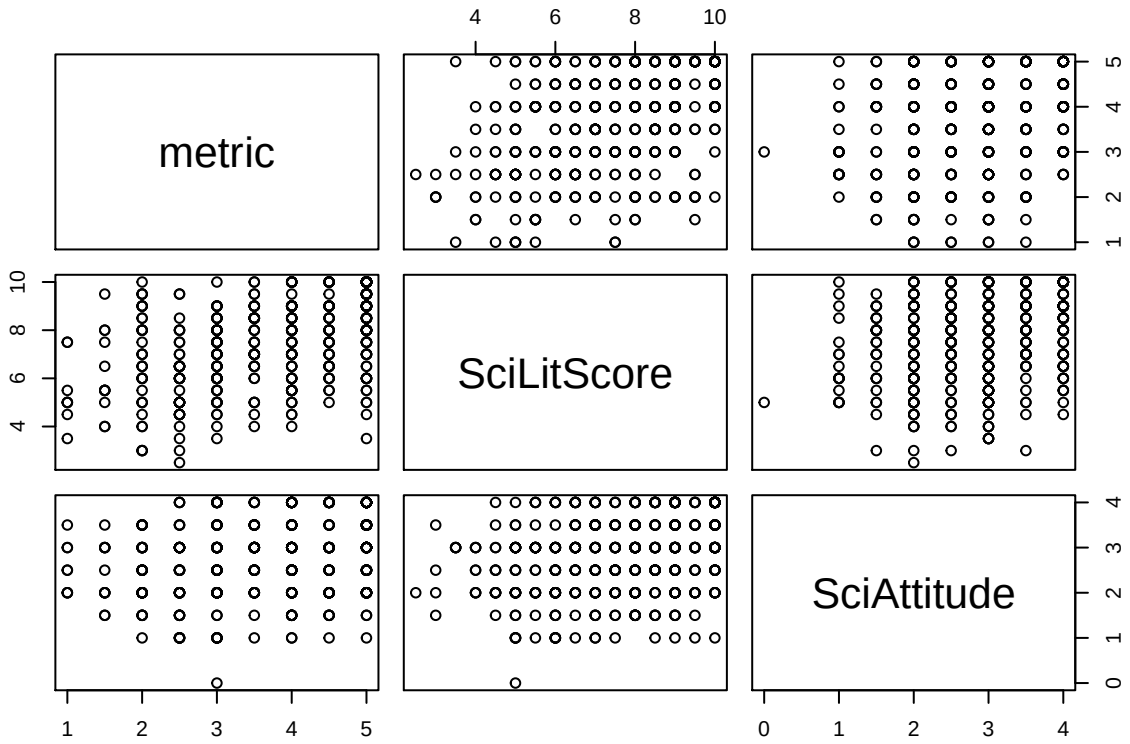
```r
tb2 = tb2[!is.na(tb2$age), ]

summary(tb2)
```

```
##     gender             degree             country            age        
##  Length:466         Length:466         Min.   :0.0000   Min.   :20.00  
##  Class :character   Class :character   1st Qu.:1.0000   1st Qu.:20.00  
##  Mode  :character   Mode  :character   Median :1.0000   Median :20.00  
##                                        Mean   :0.8605   Mean   :29.25  
##                                        3rd Qu.:1.0000   3rd Qu.:35.50  
##                                        Max.   :1.0000   Max.   :65.00  
##       shaq             kilo               mm              inseam      
##  Min.   :0.0000   Min.   :0.0000   Min.   :0.0000   Min.   :0.00  
##  1st Qu.:0.5000   1st Qu.:1.0000   1st Qu.:0.0000   1st Qu.:0.50  
##  Median :1.0000   Median :1.0000   Median :1.0000   Median :1.00  
##  Mean   :0.7532   Mean   :0.8991   Mean   :0.5966   Mean   :0.75  
##  3rd Qu.:1.0000   3rd Qu.:1.0000   3rd Qu.:1.0000   3rd Qu.:1.00  
##  Max.   :1.0000   Max.   :1.0000   Max.   :1.0000   Max.   :1.00  
##     weather          metric     religiousView      dailyLife      
##  Min.   :0.000   Min.   :1.00   Min.   :0.0000   Min.   :0.0000  
##  1st Qu.:0.500   1st Qu.:3.00   1st Qu.:0.0000   1st Qu.:0.5000  
##  Median :1.000   Median :4.00   Median :0.5000   Median :1.0000  
##  Mean   :0.721   Mean   :3.72   Mean   :0.4828   Mean   :0.7897  
##  3rd Qu.:1.000   3rd Qu.:5.00   3rd Qu.:1.0000   3rd Qu.:1.0000  
##  Max.   :1.000   Max.   :5.00   Max.   :1.0000   Max.   :1.0000  
##    SciOnLife        SciEffect       SciAttitude        light       
##  Min.   :0.0000   Min.   :0.0000   Min.   :0.000   Min.   :0.0000  
##  1st Qu.:1.0000   1st Qu.:0.5000   1st Qu.:2.000   1st Qu.:1.0000  
##  Median :1.0000   Median :1.0000   Median :3.000   Median :1.0000  
##  Mean   :0.8873   Mean   :0.6631   Mean   :2.823   Mean   :0.8069  
##  3rd Qu.:1.0000   3rd Qu.:1.0000   3rd Qu.:3.500   3rd Qu.:1.0000  
##  Max.   :1.0000   Max.   :1.0000   Max.   :4.000   Max.   :1.0000  
##      fossil            food         electronCharge     earlyHuman     
##  Min.   :0.0000   Min.   :0.0000   Min.   :0.0000   Min.   :0.0000  
##  1st Qu.:0.0000   1st Qu.:0.5000   1st Qu.:0.0000   1st Qu.:0.5000  
##  Median :1.0000   Median :1.0000   Median :1.0000   Median :1.0000  
##  Mean   :0.5655   Mean   :0.6878   Mean   :0.7082   Mean   :0.7693  
##  3rd Qu.:1.0000   3rd Qu.:1.0000   3rd Qu.:1.0000   3rd Qu.:1.0000  
##  Max.   :1.0000   Max.   :1.0000   Max.   :1.0000   Max.   :1.0000  
##      laser          continents      antibiotics      electronSize    
##  Min.   :0.0000   Min.   :0.0000   Min.   :0.0000   Min.   :0.0000  
##  1st Qu.:0.5000   1st Qu.:1.0000   1st Qu.:0.0000   1st Qu.:0.5000  
##  Median :1.0000   Median :1.0000   Median :1.0000   Median :1.0000  
##  Mean   :0.7114   Mean   :0.9163   Mean   :0.7071   Mean   :0.7296  
##  3rd Qu.:1.0000   3rd Qu.:1.0000   3rd Qu.:1.0000   3rd Qu.:1.0000  
##  Max.   :1.0000   Max.   :1.0000   Max.   :1.0000   Max.   :1.0000  
##   earthCenter      SciLitScore    
##  Min.   :0.0000   Min.   : 2.500  
##  1st Qu.:1.0000   1st Qu.: 6.000  
##  Median :1.0000   Median : 8.000  
##  Mean   :0.9152   Mean   : 7.517  
##  3rd Qu.:1.0000   3rd Qu.: 9.000  
##  Max.   :1.0000   Max.   :10.000
```

```r
str(tb2);
```

```
## 'data.frame':    466 obs. of  26 variables:
##  $ gender        : chr  "Do not wish to answer" "Male" "Female" "Female" ...
##  $ degree        : chr  "Bachelor Degree in Science or equivalent" "High School or equivalent" "High
##  $ country       : num  1 1 1 1 1 1 1 1 0 1 ...
##  $ age           : num  20 20 35.5 53 58 20 45.5 35.5 35.5 20 ...
##  $ shaq          : num  1 0 0 0 0 0.5 0 1 0 0 ...
##  $ kilo          : num  1 1 0 0 1 0 1 1 1 1 ...
##  $ mm            : num  1 1 0 1 1 0 1 1 0 1 ...
##  $ inseam        : num  0 1 1 0 1 0.5 1 1 1 0.5 ...
##  $ weather       : num  0 1 0.5 0 1 0 1 1 1 0.5 ...
##  $ metric        : num  3 4 1.5 1 4 1 4 5 3 3 ...
##  $ religiousView : num  0 0 0 1 1 1 1 1 1 0 ...
##  $ dailyLife     : num  1 1 0.5 1 1 0 1 1 1 0.5 ...
##  $ SciOnLife     : num  1 1 1 1 1 1 1 1 1 1 ...
##  $ SciEffect     : num  1 1 0 0.5 1 0 0.5 1 1 1 ...
##  $ SciAttitude   : num  3 3 1.5 3.5 4 2 3.5 4 4 2.5 ...
##  $ light         : num  1 1 1 0.5 0 1 0 1 1 0.5 ...
##  $ fossil        : num  0 0 0 0 1 0 1 1 0 0 ...
##  $ food          : num  0.5 1 1 1 1 0 1 1 1 1 ...
##  $ electronCharge: num  0 1 1 0 1 1 1 1 1 1 ...
##  $ earlyHuman    : num  1 1 0 1 1 1 1 1 1 1 ...
##  $ laser         : num  0 1 1 1 1 0.5 1 0 1 0.5 ...
##  $ continents    : num  1 1 1 0 1 1 1 1 1 0.5 ...
##  $ antibiotics   : num  1 1 1 0 1 1 1 1 1 0 ...
##  $ electronSize  : num  1 1 1 1 1 1 1 1 1 0.5 ...
##  $ earthCenter   : num  1 1 1 0.5 1 1 1 1 1 1 ...
##  $ SciLitScore   : num  6.5 9 8 5 9 7.5 9 9 9 6 ...
```

```r
pairs(tb2[, c("metric", "SciLitScore", "SciAttitude")])
```




```
summary(lm(tb2$SciLitScore ~ tb2$metric )) #significant
```

```
##
## Call:
## lm(formula = tb2$SciLitScore ~ tb2$metric)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -5.0175 -1.0175  0.0455  1.2640  3.8270
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept)  4.61000    0.25504   18.08   <2e-16 ***
## tb2$metric   0.78151    0.06577   11.88   <2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1.554 on 464 degrees of freedom
## Multiple R-squared:  0.2333, Adjusted R-squared:  0.2316
## F-statistic: 141.2 on 1 and 464 DF,  p-value: < 2.2e-16
```

```
summary(lm(tb2$SciAttitude ~ tb2$metric )) #significant
```

```
##
## Call:
## lm(formula = tb2$SciAttitude ~ tb2$metric)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -2.65123 -0.60421  0.08729  0.70656  1.46803
##
```

```
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept)  1.93565    0.13249  14.610  < 2e-16 ***
## tb2$metric   0.23853    0.03417   6.981 1.02e-11 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.8073 on 464 degrees of freedom
## Multiple R-squared:  0.09505,    Adjusted R-squared:  0.0931
## F-statistic: 48.73 on 1 and 464 DF,  p-value: 1.02e-11
```

```
summary(lm(tb2$SciAttitude ~ tb2$SciLitScore )) #significant
```

```
##
## Call:
## lm(formula = tb2$SciAttitude ~ tb2$SciLitScore)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -2.47689 -0.59557  0.04191  0.67940  1.59186
##
## Coefficients:
##                 Estimate Std. Error t value Pr(>|t|)
## (Intercept)      1.78946    0.16420  10.898  < 2e-16 ***
## tb2$SciLitScore  0.13749    0.02126   6.466 2.55e-10 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.8128 on 464 degrees of freedom
## Multiple R-squared:  0.08267,    Adjusted R-squared:  0.08069
## F-statistic: 41.81 on 1 and 464 DF,  p-value: 2.548e-10
```

```
summary(lm(tb2$SciAttitude ~ tb2$age )) #significant
```

```
##
## Call:
## lm(formula = tb2$SciAttitude ~ tb2$age)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -2.63303 -0.63303  0.06745  0.44253  1.36697
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept) 2.222162   0.083540  26.600  < 2e-16 ***
## tb2$age     0.020543   0.002564   8.013 9.13e-15 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.7954 on 464 degrees of freedom
## Multiple R-squared:  0.1216, Adjusted R-squared:  0.1197
## F-statistic: 64.21 on 1 and 464 DF,  p-value: 9.13e-15
```

```
summary(lm(tb2$metric ~ tb2$age )) #significant
```

```
##
```

```
## Call:
## lm(formula = tb2$metric ~ tb2$age)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -3.2702 -0.6777  0.2068  0.9223  1.4223
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept) 3.269856   0.112828  28.981  < 2e-16 ***
## tb2$age     0.015390   0.003462   4.445  1.1e-05 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1.074 on 464 degrees of freedom
## Multiple R-squared:  0.04084,    Adjusted R-squared:  0.03877
## F-statistic: 19.76 on 1 and 464 DF,  p-value: 1.101e-05
```

```
summary(lm(tb2$SciAttitude ~ tb2$SciLitScore + tb2$metric )) #significant
```

```
##
## Call:
## lm(formula = tb2$SciAttitude ~ tb2$SciLitScore + tb2$metric)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -2.48227 -0.56872  0.08597  0.71000  1.51677
##
## Coefficients:
##                 Estimate Std. Error t value Pr(>|t|)
## (Intercept)      1.53712    0.17073   9.003  < 2e-16 ***
## tb2$SciLitScore  0.08645    0.02381   3.631 0.000313 ***
## tb2$metric       0.17097    0.03852   4.438 1.13e-05 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.7969 on 463 degrees of freedom
## Multiple R-squared:  0.1201, Adjusted R-squared:  0.1163
## F-statistic:  31.6 on 2 and 463 DF,  p-value: 1.367e-13
```

```
## metric -> SciAttitude and SciLitScore


summary(lm(tb2$SciAttitude ~ tb2$metric + tb2$age + tb2$gender + tb2$country  )) #only metric is signif
```

```
##
## Call:
## lm(formula = tb2$SciAttitude ~ tb2$metric + tb2$age + tb2$gender +
##     tb2$country)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -2.49766 -0.57723  0.09743  0.52201  1.58191
##
## Coefficients:
```

```
##                   Estimate Std. Error t value Pr(>|t|)
## (Intercept)       1.587884   0.379827   4.181 3.48e-05 ***
## tb2$metric        0.159142   0.033766   4.713 3.24e-06 ***
## tb2$age           0.011828   0.002918   4.054 5.92e-05 ***
## tb2$genderFemale  0.286182   0.344940   0.830   0.4072
## tb2$genderMale    0.655083   0.348108   1.882   0.0605 .
## tb2$country      -0.090385   0.106665  -0.847   0.3972
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.7576 on 460 degrees of freedom
## Multiple R-squared:  0.2099, Adjusted R-squared:  0.2013
## F-statistic: 24.44 on 5 and 460 DF,  p-value: < 2.2e-16
```

```
summary(lm(tb2$SciLitScore ~ tb2$metric + tb2$age + tb2$gender + tb2$country  )) #only metric is signif
```

```
##
## Call:
## lm(formula = tb2$SciLitScore ~ tb2$metric + tb2$age + tb2$gender +
##     tb2$country)
##
## Residuals:
##    Min     1Q Median     3Q    Max
## -4.601 -1.124  0.079  1.137  3.760
##
## Coefficients:
##                   Estimate Std. Error t value Pr(>|t|)
## (Intercept)       5.690047   0.756965   7.517 2.96e-13 ***
## tb2$metric        0.681184   0.067292  10.123  < 2e-16 ***
## tb2$age           0.006659   0.005815   1.145    0.253
## tb2$genderFemale -1.127947   0.687438  -1.641    0.102
## tb2$genderMale   -0.346016   0.693750  -0.499    0.618
## tb2$country       0.022777   0.212575   0.107    0.915
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1.51 on 460 degrees of freedom
## Multiple R-squared:  0.2825, Adjusted R-squared:  0.2747
## F-statistic: 36.22 on 5 and 460 DF,  p-value: < 2.2e-16
```

```
summary(lm(tb2$SciLitScore ~ tb2$country)) #p=0.0009, but seems due to metric?
```

```
##
## Call:
## lm(formula = tb2$SciLitScore ~ tb2$country)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -4.9165 -1.4165  0.0835  1.5835  2.5835
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept)   8.1385     0.2179  37.347  < 2e-16 ***
## tb2$country  -0.7220     0.2349  -3.073  0.00224 **
## ---
```

```
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1.757 on 464 degrees of freedom
## Multiple R-squared:  0.01995,    Adjusted R-squared:  0.01784
## F-statistic: 9.446 on 1 and 464 DF,  p-value: 0.00224
```

```
summary(lm(tb2$SciLitScore ~ tb2$metric + tb2$country  )) #only metric is significant
```

```
##
## Call:
## lm(formula = tb2$SciLitScore ~ tb2$metric + tb2$country)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -5.2331 -0.9587  0.0722  1.2669  3.8376
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept)  4.90601    0.34185  14.351   <2e-16 ***
## tb2$metric   0.76543    0.06688  11.445   <2e-16 ***
## tb2$country -0.27448    0.21127  -1.299    0.195
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1.553 on 463 degrees of freedom
## Multiple R-squared:  0.2361, Adjusted R-squared:  0.2328
## F-statistic: 71.54 on 2 and 463 DF,  p-value: < 2.2e-16
```

```
summary(lm(tb2$SciAttitude ~ tb2$country)) #p=0.0127, but seems due to metric?
```

```
##
## Call:
## lm(formula = tb2$SciAttitude ~ tb2$country)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -2.7668 -0.7668  0.2332  0.7332  1.2332
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept)   3.1692     0.1038  30.526  < 2e-16 ***
## tb2$country  -0.4024     0.1119  -3.595 0.000359 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.837 on 464 degrees of freedom
## Multiple R-squared:  0.0271, Adjusted R-squared:  0.02501
## F-statistic: 12.93 on 1 and 464 DF,  p-value: 0.0003586
```

```
summary(lm(tb2$SciAttitude ~ tb2$country + tb2$metric)) #country not significant when controled for met
```

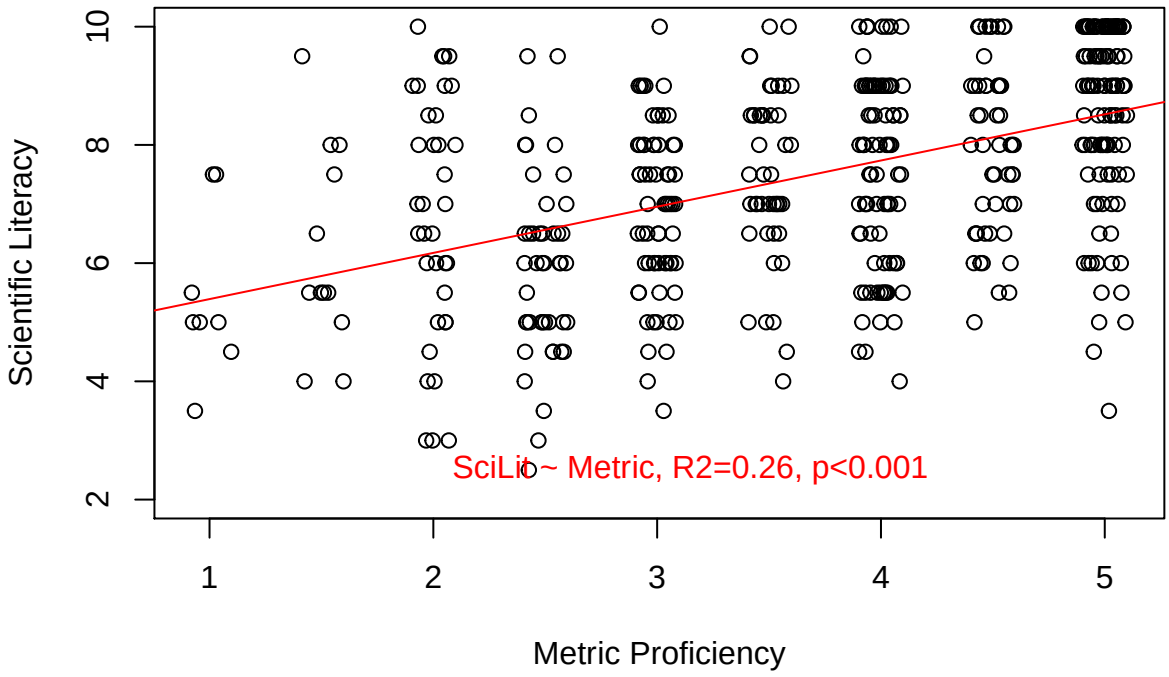
```
##
## Call:
## lm(formula = tb2$SciAttitude ~ tb2$country + tb2$metric)
##
## Residuals:
```

```
##     Min      1Q  Median      3Q     Max
## -2.6247 -0.5699  0.0414  0.6579  1.4866
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept)  2.22928    0.17673  12.614  < 2e-16 ***
## tb2$country -0.27226    0.10923  -2.493    0.013 *
## tb2$metric   0.22258    0.03458   6.437 3.04e-10 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.8028 on 463 degrees of freedom
## Multiple R-squared:  0.107,  Adjusted R-squared:  0.1032
## F-statistic: 27.75 on 2 and 463 DF,  p-value: 4.158e-12
```

```
plot( tb2$SciLitScore ~ jitter(tb2$metric), xlab='Metric Proficiency', ylab='Scientific Literacy', ylim=
m1 = lm(tb2$SciLitScore ~ tb2$metric )
abline(m1, col='red')
summary(m1)
```

```
##
## Call:
## lm(formula = tb2$SciLitScore ~ tb2$metric)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -5.0175 -1.0175  0.0455  1.2640  3.8270
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept)  4.61000    0.25504   18.08   <2e-16 ***
## tb2$metric   0.78151    0.06577   11.88   <2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1.554 on 464 degrees of freedom
## Multiple R-squared:  0.2333, Adjusted R-squared:  0.2316
## F-statistic: 141.2 on 1 and 464 DF,  p-value: < 2.2e-16
```

```
text(2, 2.5, "SciLit ~ Metric, R2=0.26, p<0.001", col="red", pos=4)
```




```
#abline(m2, col='blue')
summary(m2)
```

```
##
## Call:
## lm(formula = tb2$metric ~ tb2$age)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -3.2702 -0.6777  0.2068  0.9223  1.4223
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept) 3.269856   0.112828  28.981  < 2e-16 ***
## tb2$age     0.015390   0.003462   4.445  1.1e-05 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1.074 on 464 degrees of freedom
##   (2 observations deleted due to missingness)
## Multiple R-squared:  0.04084,    Adjusted R-squared:  0.03877
## F-statistic: 19.76 on 1 and 464 DF,  p-value: 1.101e-05
```

```
m2 = lm(tb2$SciLitScore ~ tb2$metric + tb2$age)
anova(m1, m2)
```

```
## Analysis of Variance Table
##
## Model 1: tb2$SciLitScore ~ tb2$metric
## Model 2: tb2$SciLitScore ~ tb2$metric + tb2$age
##   Res.Df    RSS Df Sum of Sq      F    Pr(>F)
## 1    464 1120.4
## 2    463 1087.7  1    32.706 13.921 0.0002143 ***
```

```
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
m3 = lm(tb2$SciLitScore ~ tb2$metric + tb2$age + tb2$gender)
summary(m3)
```

```
##
## Call:
## lm(formula = tb2$SciLitScore ~ tb2$metric + tb2$age + tb2$gender)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -4.6211 -1.1210  0.0798  1.1406  3.7601
##
## Coefficients:
##                    Estimate Std. Error t value Pr(>|t|)
## (Intercept)        5.707877   0.737654   7.738 6.44e-14 ***
## tb2$metric         0.680345   0.066764  10.190  < 2e-16 ***
## tb2$age            0.006622   0.005798   1.142    0.254
## tb2$genderFemale -1.120955   0.683600  -1.640    0.102
## tb2$genderMale   -0.342772   0.692346  -0.495    0.621
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1.508 on 461 degrees of freedom
## Multiple R-squared:  0.2825, Adjusted R-squared:  0.2762
## F-statistic: 45.37 on 4 and 461 DF,  p-value: < 2.2e-16
```

```
anova(m2,m3)
```

```
## Analysis of Variance Table
##
## Model 1: tb2$SciLitScore ~ tb2$metric + tb2$age
## Model 2: tb2$SciLitScore ~ tb2$metric + tb2$age + tb2$gender
##   Res.Df    RSS Df Sum of Sq      F    Pr(>F)
## 1    463 1087.7
## 2    461 1048.6  2    39.162 8.6086 0.0002135 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
m4 = lm(tb2$SciLitScore ~ tb2$metric + tb2$age + tb2$country)
anova(m2, m4)
```

```
## Analysis of Variance Table
##
## Model 1: tb2$SciLitScore ~ tb2$metric + tb2$age
## Model 2: tb2$SciLitScore ~ tb2$metric + tb2$age + tb2$country
##   Res.Df    RSS Df Sum of Sq      F Pr(>F)
## 1    463 1087.7
## 2    462 1086.7  1    1.0533 0.4478 0.5037
```

```
#text(2, 2, "SciLit ~ Metric + Age, R2=0.29, p=2.8E-14", col="blue", pos=4)

plot( tb2$SciAttitude ~ jitter(tb2$metric), ylim=c(0.5,4), xlab='Metric Proficiency', ylab='Attitude tow
m1 = lm( tb2$SciAttitude ~ tb2$metric )
m2 = lm( tb2$SciAttitude ~ tb2$metric + tb2$age )
abline(m1, col='red')
```

```r
abline(m2, col='blue')
```

```
## Warning in abline(m2, col = "blue"): only using the first two of 3
## regression coefficients
```

```r
summary(m1)
```

```
##
## Call:
## lm(formula = tb2$SciAttitude ~ tb2$metric)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -2.65123 -0.60421  0.08729  0.70656  1.46803
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept)  1.93565    0.13249  14.610  < 2e-16 ***
## tb2$metric   0.23853    0.03417   6.981 1.02e-11 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.8073 on 464 degrees of freedom
## Multiple R-squared:  0.09505,    Adjusted R-squared:  0.0931
## F-statistic: 48.73 on 1 and 464 DF,  p-value: 1.02e-11
```

```r
summary(m2)
```

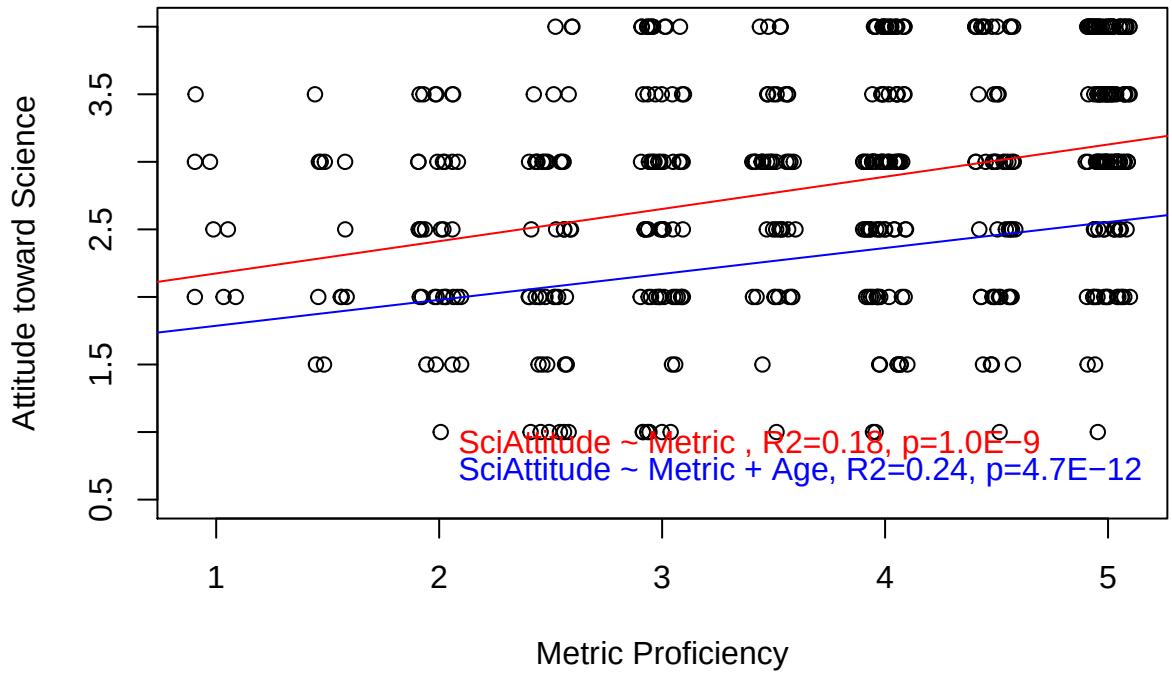
```
##
## Call:
## lm(formula = tb2$SciAttitude ~ tb2$metric + tb2$age)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -2.5222 -0.5956  0.0941  0.5737  1.5737
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept) 1.594854   0.135406  11.778  < 2e-16 ***
## tb2$metric  0.191846   0.033235   5.772 1.43e-08 ***
## tb2$age     0.017591   0.002531   6.950 1.25e-11 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.769 on 463 degrees of freedom
## Multiple R-squared:  0.1805, Adjusted R-squared:  0.177
## F-statistic:    51 on 2 and 463 DF,  p-value: < 2.2e-16
```

```r
anova(m1, m2)
```

```
## Analysis of Variance Table
##
## Model 1: tb2$SciAttitude ~ tb2$metric
## Model 2: tb2$SciAttitude ~ tb2$metric + tb2$age
##   Res.Df    RSS Df Sum of Sq      F    Pr(>F)
## 1    464 302.38
```

```
## 2    463 273.82  1    28.566 48.302 1.247e-11 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

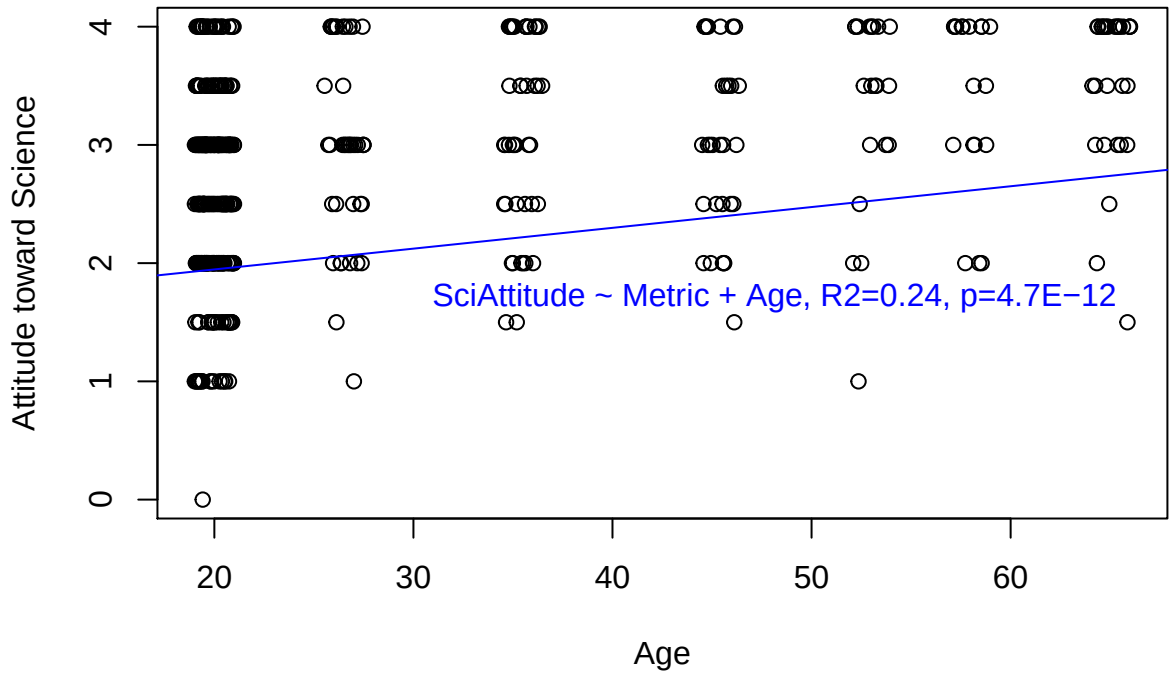
```
text(2, 0.9, "SciAttitude ~ Metric , R2=0.18, p=1.0E-9", col="red", pos=4)
text(2, 0.7, "SciAttitude ~ Metric + Age, R2=0.24, p=4.7E-12", col="blue", pos=4)
```




```
plot( tb2$SciAttitude ~ jitter(tb2$age), ylab='Attitude toward Science', xlab='Age')
m2 = lm( tb2$SciAttitude ~ tb2$age + tb2$metric)
abline(m2, col='blue')
```

```
## Warning in abline(m2, col = "blue"): only using the first two of 3
## regression coefficients
```

```
text(30, 1.7, "SciAttitude ~ Metric + Age, R2=0.24, p=4.7E-12", col="blue", pos=4)
```




```
summary(lm(tb2$SciAttitude ~ tb2$metric + tb2$age + tb2$gender + tb2$country  )) #age is signicant!!!
```

```
##
## Call:
## lm(formula = tb2$SciAttitude ~ tb2$metric + tb2$age + tb2$gender +
##     tb2$country)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -2.49766 -0.57723  0.09743  0.52201  1.58191
##
## Coefficients:
##                   Estimate Std. Error t value Pr(>|t|)
## (Intercept)       1.587884   0.379827   4.181 3.48e-05 ***
## tb2$metric        0.159142   0.033766   4.713 3.24e-06 ***
## tb2$age           0.011828   0.002918   4.054 5.92e-05 ***
## tb2$genderFemale  0.286182   0.344940   0.830   0.4072
## tb2$genderMale    0.655083   0.348108   1.882   0.0605 .
## tb2$country      -0.090385   0.106665  -0.847   0.3972
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.7576 on 460 degrees of freedom
## Multiple R-squared:  0.2099, Adjusted R-squared:  0.2013
## F-statistic: 24.44 on 5 and 460 DF,  p-value: < 2.2e-16
```

```
#but this might be a bias in the sample
# 1) there is many faculty
# 2) people took the sample may be interested in the metric and science at the first place?!
summary(lm(tb2$SciAttitude ~ tb2$metric + tb2$age + tb2$gender + tb2$country + tb2$degree  )) #age is s
```

```
##
## Call:
```

```
## lm(formula = tb2$SciAttitude ~ tb2$metric + tb2$age + tb2$gender +
##     tb2$country + tb2$degree)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -2.53945 -0.56207  0.09692  0.51055  1.66144
##
## Coefficients:
##                                                    Estimate Std. Error
## (Intercept)                                        1.713457   0.388266
## tb2$metric                                         0.150168   0.034488
## tb2$age                                            0.009874   0.003274
## tb2$genderFemale                                   0.256995   0.343322
## tb2$genderMale                                     0.632002   0.348362
## tb2$country                                       -0.090303   0.106181
## tb2$degreeBachelor Degree in Science or equivalent 0.011310   0.116875
## tb2$degreeHigh School or equivalent               -0.189572   0.123585
## tb2$degreeM.D. or equivalent                       0.798322   0.321697
## tb2$degreeMaster Degree or equivalent              0.225278   0.164419
## tb2$degreePh.D. or equivalent                      0.020862   0.149368
##                                                   t value Pr(>|t|)
## (Intercept)                                         4.413 1.27e-05 ***
## tb2$metric                                          4.354 1.65e-05 ***
## tb2$age                                             3.016   0.0027 **
## tb2$genderFemale                                    0.749   0.4545
## tb2$genderMale                                      1.814   0.0703 .
## tb2$country                                        -0.850   0.3955
## tb2$degreeBachelor Degree in Science or equivalent  0.097   0.9229
## tb2$degreeHigh School or equivalent                -1.534   0.1257
## tb2$degreeM.D. or equivalent                        2.482   0.0134 *
## tb2$degreeMaster Degree or equivalent               1.370   0.1713
## tb2$degreePh.D. or equivalent                       0.140   0.8890
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.7482 on 455 degrees of freedom
## Multiple R-squared:  0.2378, Adjusted R-squared:  0.2211
## F-statistic:  14.2 on 10 and 455 DF,  p-value: < 2.2e-16
```

```
summary(lm(tb2$SciAttitude ~ tb2$SciLitScore))
```

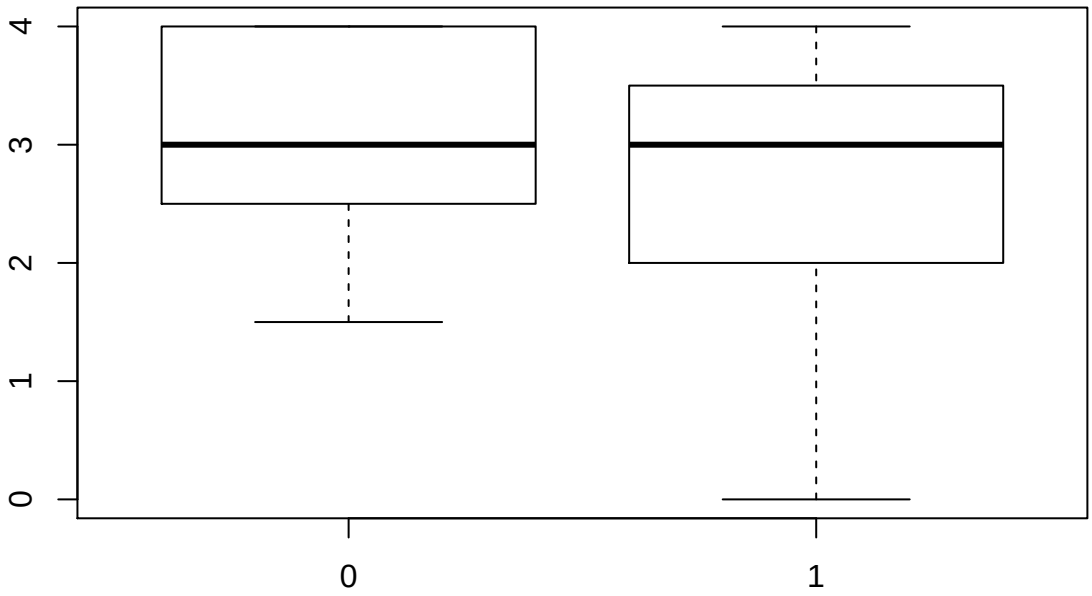
```
##
## Call:
## lm(formula = tb2$SciAttitude ~ tb2$SciLitScore)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -2.47689 -0.59557  0.04191  0.67940  1.59186
##
## Coefficients:
##                 Estimate Std. Error t value Pr(>|t|)
## (Intercept)      1.78946    0.16420  10.898  < 2e-16 ***
## tb2$SciLitScore  0.13749    0.02126   6.466 2.55e-10 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
##
## Residual standard error: 0.8128 on 464 degrees of freedom
## Multiple R-squared:  0.08267,    Adjusted R-squared:  0.08069
## F-statistic: 41.81 on 1 and 464 DF,  p-value: 2.548e-10
```

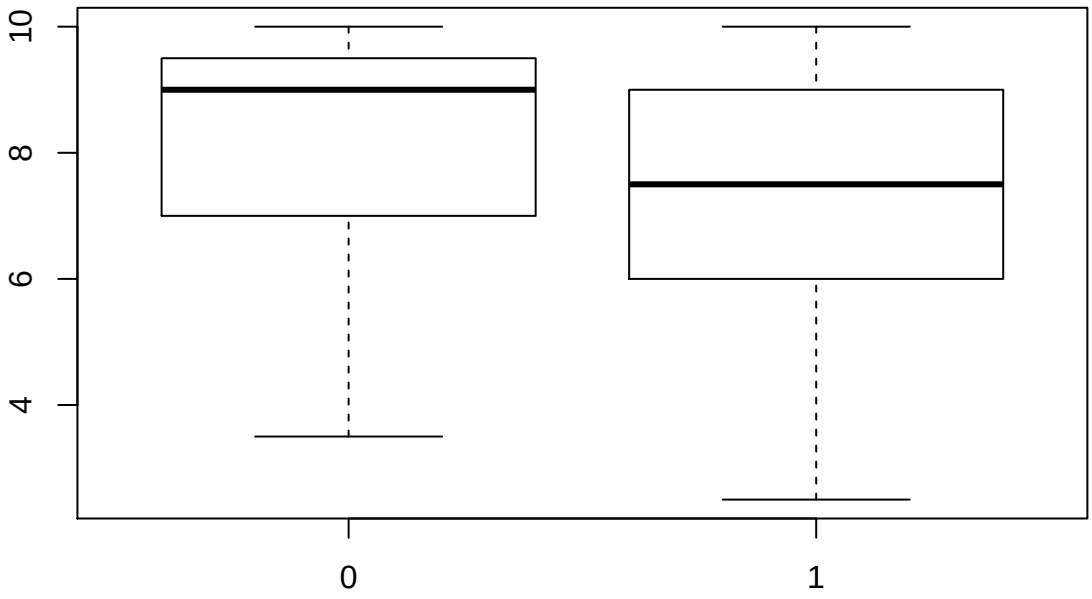
```
summary(lm(tb2$SciAttitude ~ tb2$SciLitScore + tb2$metric))
```

```
##
## Call:
## lm(formula = tb2$SciAttitude ~ tb2$SciLitScore + tb2$metric)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -2.48227 -0.56872  0.08597  0.71000  1.51677
##
## Coefficients:
##                 Estimate Std. Error t value Pr(>|t|)
## (Intercept)      1.53712    0.17073   9.003  < 2e-16 ***
## tb2$SciLitScore  0.08645    0.02381   3.631 0.000313 ***
## tb2$metric       0.17097    0.03852   4.438 1.13e-05 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.7969 on 463 degrees of freedom
## Multiple R-squared:  0.1201, Adjusted R-squared:  0.1163
## F-statistic:  31.6 on 2 and 463 DF,  p-value: 1.367e-13
```

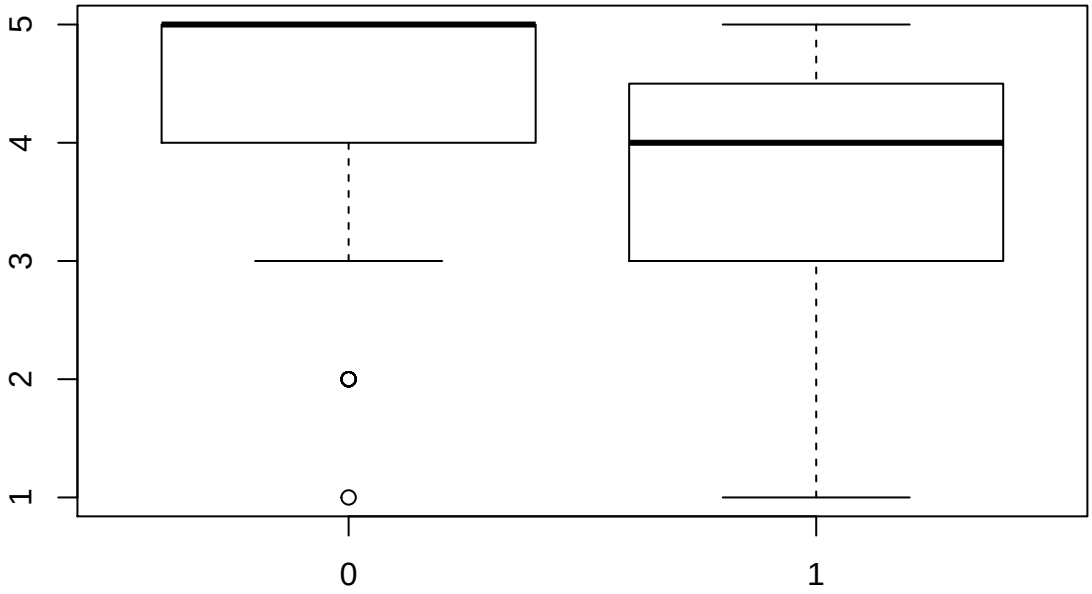
```
boxplot( tb2$SciAttitude ~ tb2$country )
```



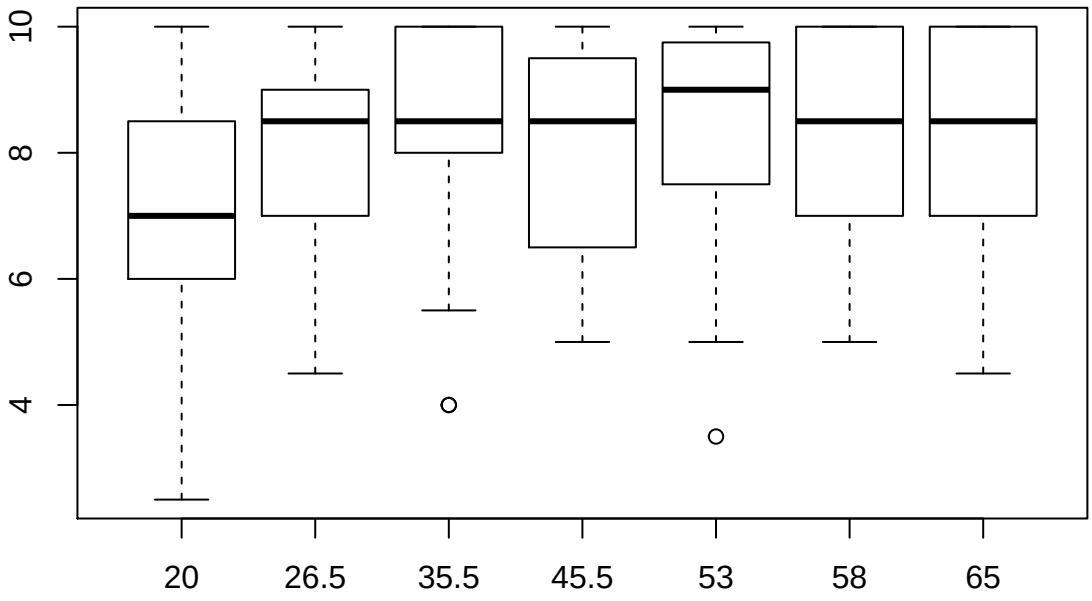

```
boxplot( tb2$SciLitScore ~ tb2$country )
```



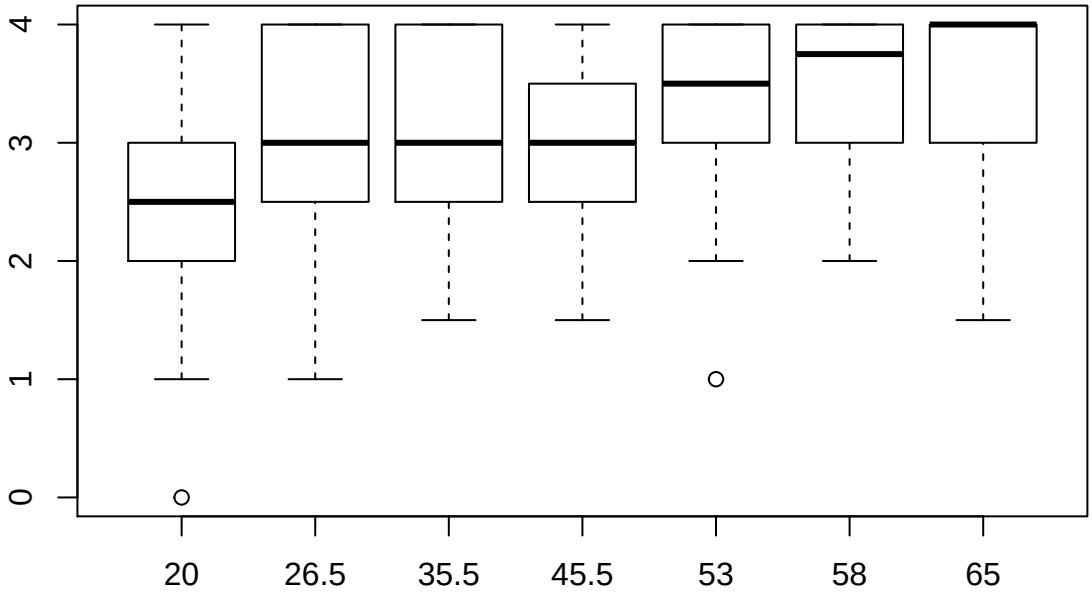

```
boxplot( tb2$metric ~ tb2$country )
```



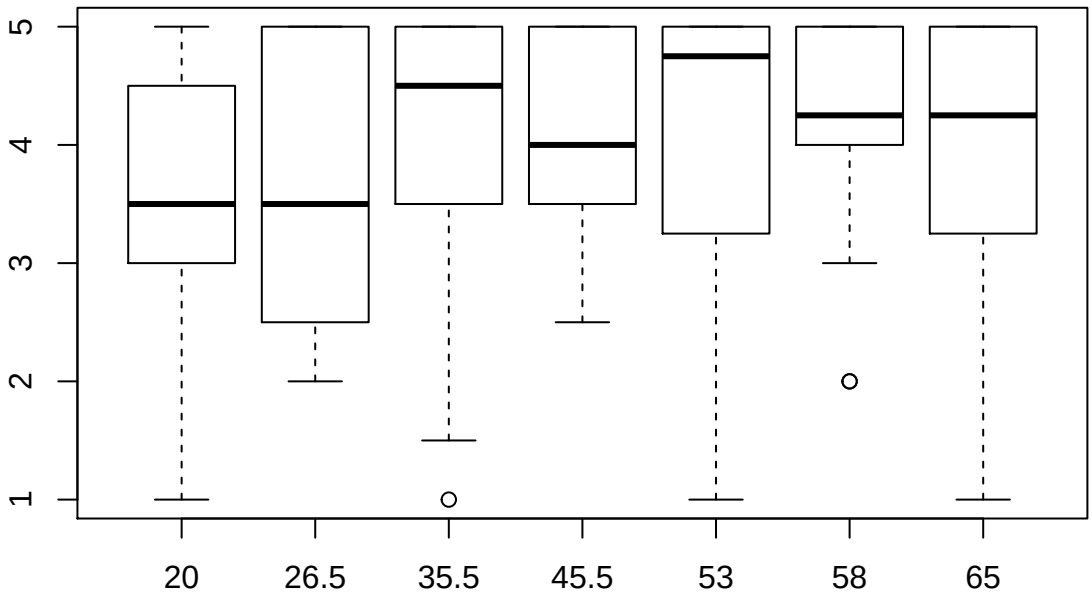

```
boxplot( tb2$SciLitScore ~ tb2$age )
```




```
boxplot( tb2$SciAttitude ~ tb2$age )
```




```
boxplot( tb2$metric ~ tb2$age )
```




```
###########
# remove phD from the samples
#
summary(tb2[, 1:5])
```

```
##     gender             degree             country           age
##  Length:466         Length:466         Min.   :0.0000   Min.   :20.00
##  Class :character   Class :character   1st Qu.:1.0000   1st Qu.:20.00
##  Mode  :character   Mode  :character   Median :1.0000   Median :20.00
##                                        Mean   :0.8605   Mean   :29.25
##                                        3rd Qu.:1.0000   3rd Qu.:35.50
##                                        Max.   :1.0000   Max.   :65.00
##       shaq
##  Min.   :0.0000
##  1st Qu.:0.5000
##  Median :1.0000
##  Mean   :0.7532
##  3rd Qu.:1.0000
##  Max.   :1.0000
```

```
tb3 = tb2[ - grep('Ph.D.', tb2$degree)  , ]
summary(tb3)
```

```
##     gender             degree             country           age
##  Length:405         Length:405         Min.   :0.000   Min.   :20.00
##  Class :character   Class :character   1st Qu.:1.000   1st Qu.:20.00
##  Mode  :character   Mode  :character   Median :1.000   Median :20.00
##                                        Mean   :0.879   Mean   :27.21
##                                        3rd Qu.:1.000   3rd Qu.:26.50
##                                        Max.   :1.000   Max.   :65.00
##       shaq              kilo               mm              inseam
##  Min.   :0.0000   Min.   :0.0000   Min.   :0.0000   Min.   :0.0000
##  1st Qu.:0.5000   1st Qu.:1.0000   1st Qu.:0.0000   1st Qu.:0.5000
##  Median :1.0000   Median :1.0000   Median :1.0000   Median :1.0000
##  Mean   :0.7481   Mean   :0.8988   Mean   :0.5753   Mean   :0.7333
##  3rd Qu.:1.0000   3rd Qu.:1.0000   3rd Qu.:1.0000   3rd Qu.:1.0000
```

```
##  Max.   :1.0000   Max.   :1.0000   Max.   :1.0000   Max.   :1.0000
##     weather         metric      religiousView      dailyLife
##  Min.   :0.0   Min.   :1.000   Min.   :0.0000   Min.   :0.0000
##  1st Qu.:0.5   1st Qu.:3.000   1st Qu.:0.0000   1st Qu.:0.5000
##  Median :1.0   Median :4.000   Median :0.5000   Median :1.0000
##  Mean   :0.7   Mean   :3.656   Mean   :0.4444   Mean   :0.7864
##  3rd Qu.:1.0   3rd Qu.:4.500   3rd Qu.:1.0000   3rd Qu.:1.0000
##  Max.   :1.0   Max.   :5.000   Max.   :1.0000   Max.   :1.0000
##    SciOnLife        SciEffect       SciAttitude        light
##  Min.   :0.0000   Min.   :0.0000   Min.   :0.000   Min.   :0.0000
##  1st Qu.:1.0000   1st Qu.:0.5000   1st Qu.:2.000   1st Qu.:1.0000
##  Median :1.0000   Median :0.5000   Median :3.000   Median :1.0000
##  Mean   :0.8938   Mean   :0.6568   Mean   :2.781   Mean   :0.8173
##  3rd Qu.:1.0000   3rd Qu.:1.0000   3rd Qu.:3.500   3rd Qu.:1.0000
##  Max.   :1.0000   Max.   :1.0000   Max.   :4.000   Max.   :1.0000
##      fossil            food        electronCharge     earlyHuman
##  Min.   :0.0000   Min.   :0.0000   Min.   :0.0000   Min.   :0.0000
##  1st Qu.:0.0000   1st Qu.:0.5000   1st Qu.:0.0000   1st Qu.:0.5000
##  Median :0.5000   Median :1.0000   Median :1.0000   Median :1.0000
##  Mean   :0.5407   Mean   :0.6617   Mean   :0.6938   Mean   :0.7568
##  3rd Qu.:1.0000   3rd Qu.:1.0000   3rd Qu.:1.0000   3rd Qu.:1.0000
##  Max.   :1.0000   Max.   :1.0000   Max.   :1.0000   Max.   :1.0000
##      laser          continents      antibiotics      electronSize
##  Min.   :0.0000   Min.   :0.0000   Min.   :0.0000   Min.   :0.0000
##  1st Qu.:0.5000   1st Qu.:1.0000   1st Qu.:0.0000   1st Qu.:0.5000
##  Median :1.0000   Median :1.0000   Median :1.0000   Median :1.0000
##  Mean   :0.6951   Mean   :0.9111   Mean   :0.6901   Mean   :0.7123
##  3rd Qu.:1.0000   3rd Qu.:1.0000   3rd Qu.:1.0000   3rd Qu.:1.0000
##  Max.   :1.0000   Max.   :1.0000   Max.   :1.0000   Max.   :1.0000
##   earthCenter      SciLitScore
##  Min.   :0.0000   Min.   : 2.500
##  1st Qu.:1.0000   1st Qu.: 6.000
##  Median :1.0000   Median : 7.500
##  Mean   :0.9148   Mean   : 7.394
##  3rd Qu.:1.0000   3rd Qu.: 9.000
##  Max.   :1.0000   Max.   :10.000
```

```
summary(lm(tb3$SciAttitude ~ tb3$metric + tb3$age + tb3$gender + tb3$country + tb3$degree ))
```

```
##
## Call:
## lm(formula = tb3$SciAttitude ~ tb3$metric + tb3$age + tb3$gender +
##     tb3$country + tb3$degree)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -2.54525 -0.54019  0.09237  0.50746  1.66622
##
## Coefficients:
##                                                  Estimate Std. Error
## (Intercept)                                      1.743049   0.562884
## tb3$metric                                       0.137612   0.036651
## tb3$age                                          0.011545   0.003648
## tb3$genderFemale                                 0.189511   0.522478
## tb3$genderMale                                   0.574496   0.533321
```

```
## tb3$country                                          -0.062100   0.118959
## tb3$degreeBachelor Degree in Science or equivalent  0.031048   0.115843
## tb3$degreeHigh School or equivalent                 -0.180423   0.121854
## tb3$degreeM.D. or equivalent                         0.798745   0.316229
## tb3$degreeMaster Degree or equivalent                0.214696   0.162761
##                                                     t value Pr(>|t|)
## (Intercept)                                           3.097  0.00210 **
## tb3$metric                                            3.755  0.00020 ***
## tb3$age                                               3.164  0.00167 **
## tb3$genderFemale                                      0.363  0.71701
## tb3$genderMale                                        1.077  0.28205
## tb3$country                                          -0.522  0.60194
## tb3$degreeBachelor Degree in Science or equivalent    0.268  0.78883
## tb3$degreeHigh School or equivalent                  -1.481  0.13950
## tb3$degreeM.D. or equivalent                          2.526  0.01193 *
## tb3$degreeMaster Degree or equivalent                 1.319  0.18790
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.7352 on 395 degrees of freedom
## Multiple R-squared:  0.2453, Adjusted R-squared:  0.2281
## F-statistic: 14.26 on 9 and 395 DF,  p-value: < 2.2e-16
```

```
#age is still signicant after PhD are removed from the sample


########Write an R function to do two-sample test.  For large sample size, exact test is unnecessary.
testTwoFactorTb2 = function( fac1, fac2) {
  tbTwo = table( tb2[,fac1], tb2[,fac2] )
  print(tbTwo)
  f = fisher.test(tbTwo)
  #f = chisq.test(tbTwo)
}

#metrics = c("shaq", "kilo", "mm", "inseam", "weather")
#sciLiteracy = c("light", "fossil", "food", "electronCharge",
#                "earlyHuman", "laser", "continents", "antibiotics", "electronSize", "earthCenter")
#sciAttitude = c("religiousView", "dailyLife", "SciOnLife", "SciEffect")

#f = testTwoFactorTb2( "shaq", "religiousView"); f
#f = testTwoFactorTb2( "shaq", "dailyLife"); f
#f = testTwoFactorTb2( "shaq", "SciOnLife"); f

#f = testTwoFactorTb2( "shaq", "SciEffect"); f #significant effect!!!!
#f = testTwoFactorTb2( "kilo", "SciEffect"); f #significant effect!!!
#f = testTwoFactorTb2( "mm", "SciEffect"); f #significant effect!!!
#f = testTwoFactorTb2( "inseam", "SciEffect"); f #significant effect!!!
#f = testTwoFactorTb2( "weather", "SciEffect"); f #p=0.078
#f = testTwoFactorTb2( "country", "SciEffect"); f #p=0.24

summary(lm(tb2$SciEffect ~ tb2$kilo + tb2$country + tb2$gender + tb2$age + tb2$degree )) #significant k
```

```
##
## Call:
## lm(formula = tb2$SciEffect ~ tb2$kilo + tb2$country + tb2$gender +
```

```
##     tb2$age + tb2$degree)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -0.90145 -0.17745  0.08031  0.35806  0.60055
##
## Coefficients:
##                                                  Estimate Std. Error
## (Intercept)                                      0.582495   0.187610
## tb2$kilo                                         0.173337   0.058421
## tb2$country                                     -0.104668   0.052001
## tb2$genderFemale                                -0.093309   0.168921
## tb2$genderMale                                   0.035429   0.171295
## tb2$age                                          0.001748   0.001611
## tb2$degreeBachelor Degree in Science or equivalent  0.049133   0.056753
## tb2$degreeHigh School or equivalent             -0.020023   0.060451
## tb2$degreeM.D. or equivalent                     0.324700   0.158279
## tb2$degreeMaster Degree or equivalent            0.034100   0.080352
## tb2$degreePh.D. or equivalent                    0.008827   0.072324
##                                                 t value Pr(>|t|)
## (Intercept)                                       3.105  0.00202 **
## tb2$kilo                                          2.967  0.00317 **
## tb2$country                                      -2.013  0.04472 *
## tb2$genderFemale                                 -0.552  0.58096
## tb2$genderMale                                    0.207  0.83624
## tb2$age                                           1.085  0.27857
## tb2$degreeBachelor Degree in Science or equivalent   0.866  0.38709
## tb2$degreeHigh School or equivalent              -0.331  0.74063
## tb2$degreeM.D. or equivalent                      2.051  0.04080 *
## tb2$degreeMaster Degree or equivalent             0.424  0.67148
## tb2$degreePh.D. or equivalent                     0.122  0.90292
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.3672 on 455 degrees of freedom
## Multiple R-squared:  0.09248,    Adjusted R-squared:  0.07253
## F-statistic: 4.637 on 10 and 455 DF,  p-value: 2.636e-06
```

```
summary(lm(tb2$SciOnLife ~ tb2$kilo + tb2$country + tb2$gender + tb2$age + tb2$degree )) #no effect
```

```
##
## Call:
## lm(formula = tb2$SciOnLife ~ tb2$kilo + tb2$country + tb2$gender +
##     tb2$age + tb2$degree)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -0.92792  0.04956  0.10778  0.11891  0.23102
##
## Coefficients:
##                                                  Estimate Std. Error
## (Intercept)                                     0.8362684  0.1354130
## tb2$kilo                                        0.0523557  0.0421667
## tb2$country                                    -0.0570500  0.0375334
## tb2$genderFemale                                0.0481823  0.1219231
```

```
## tb2$genderMale                                          0.0747536  0.1236369
## tb2$age                                                 0.0002403  0.0011628
## tb2$degreeBachelor Degree in Science or equivalent      0.0076568  0.0409629
## tb2$degreeHigh School or equivalent                    -0.0300467  0.0436323
## tb2$degreeM.D. or equivalent                            0.0106936  0.1142420
## tb2$degreeMaster Degree or equivalent                   0.0449160  0.0579963
## tb2$degreePh.D. or equivalent                          -0.0632310  0.0522019
##                                                        t value Pr(>|t|)
## (Intercept)                                              6.176 1.46e-09 ***
## tb2$kilo                                                 1.242    0.215
## tb2$country                                             -1.520    0.129
## tb2$genderFemale                                         0.395    0.693
## tb2$genderMale                                           0.605    0.546
## tb2$age                                                  0.207    0.836
## tb2$degreeBachelor Degree in Science or equivalent       0.187    0.852
## tb2$degreeHigh School or equivalent                     -0.689    0.491
## tb2$degreeM.D. or equivalent                             0.094    0.925
## tb2$degreeMaster Degree or equivalent                    0.774    0.439
## tb2$degreePh.D. or equivalent                           -1.211    0.226
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.265 on 455 degrees of freedom
## Multiple R-squared:  0.02657,    Adjusted R-squared:  0.00518
## F-statistic: 1.242 on 10 and 455 DF,  p-value: 0.2615
```

```
summary(lm(tb2$religiousView ~ tb2$kilo + tb2$country + tb2$gender + tb2$age + tb2$degree )) #age effec
```

```
##
## Call:
## lm(formula = tb2$religiousView ~ tb2$kilo + tb2$country + tb2$gender +
##     tb2$age + tb2$degree)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -0.93497 -0.29945 -0.01303  0.31567  0.72047
##
## Coefficients:
##                                                         Estimate Std. Error
## (Intercept)                                             0.485898   0.211422
## tb2$kilo                                                0.006538   0.065835
## tb2$country                                            -0.104749   0.058601
## tb2$genderFemale                                       -0.043172   0.190360
## tb2$genderMale                                          0.177685   0.193036
## tb2$age                                                 0.006887   0.001815
## tb2$degreeBachelor Degree in Science or equivalent     -0.196187   0.063956
## tb2$degreeHigh School or equivalent                    -0.182804   0.068124
## tb2$degreeM.D. or equivalent                            0.089433   0.178368
## tb2$degreeMaster Degree or equivalent                  -0.089009   0.090550
## tb2$degreePh.D. or equivalent                          -0.013430   0.081504
##                                                        t value Pr(>|t|)
## (Intercept)                                              2.298 0.022001 *
## tb2$kilo                                                 0.099 0.920937
## tb2$country                                             -1.787 0.074524 .
## tb2$genderFemale                                        -0.227 0.820687
```

```
## tb2$genderMale                                          0.920 0.357811
## tb2$age                                                 3.794 0.000169 ***
## tb2$degreeBachelor Degree in Science or equivalent     -3.068 0.002287 **
## tb2$degreeHigh School or equivalent                    -2.683 0.007553 **
## tb2$degreeM.D. or equivalent                            0.501 0.616335
## tb2$degreeMaster Degree or equivalent                  -0.983 0.326142
## tb2$degreePh.D. or equivalent                          -0.165 0.869191
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.4138 on 455 degrees of freedom
## Multiple R-squared:  0.2313, Adjusted R-squared:  0.2144
## F-statistic: 13.69 on 10 and 455 DF,  p-value: < 2.2e-16
```

```
summary(lm(tb2$dailyLife ~ tb2$kilo + tb2$country + tb2$gender + tb2$age + tb2$degree )) #gender
```

```
##
## Call:
## lm(formula = tb2$dailyLife ~ tb2$kilo + tb2$country + tb2$gender +
##     tb2$age + tb2$degree)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -0.9069 -0.1571  0.1628  0.1927  0.6887
##
## Coefficients:
##                                                    Estimate Std. Error
## (Intercept)                                        0.065668   0.174932
## tb2$kilo                                           0.044638   0.054473
## tb2$country                                        0.117550   0.048487
## tb2$genderFemale                                   0.355340   0.157505
## tb2$genderMale                                     0.412733   0.159719
## tb2$age                                            0.001887   0.001502
## tb2$degreeBachelor Degree in Science or equivalent 0.216317   0.052918
## tb2$degreeHigh School or equivalent                0.080848   0.056366
## tb2$degreeM.D. or equivalent                       0.355637   0.147583
## tb2$degreeMaster Degree or equivalent              0.296546   0.074922
## tb2$degreePh.D. or equivalent                      0.178696   0.067437
##                                                    t value Pr(>|t|)
## (Intercept)                                          0.375  0.70754
## tb2$kilo                                             0.819  0.41296
## tb2$country                                          2.424  0.01572 *
## tb2$genderFemale                                     2.256  0.02454 *
## tb2$genderMale                                       2.584  0.01007 *
## tb2$age                                              1.256  0.20978
## tb2$degreeBachelor Degree in Science or equivalent   4.088 5.15e-05 ***
## tb2$degreeHigh School or equivalent                  1.434  0.15216
## tb2$degreeM.D. or equivalent                         2.410  0.01636 *
## tb2$degreeMaster Degree or equivalent                3.958 8.77e-05 ***
## tb2$degreePh.D. or equivalent                        2.650  0.00833 **
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.3424 on 455 degrees of freedom
## Multiple R-squared:  0.1019, Adjusted R-squared:  0.08212
```

```
## F-statistic:  5.16 on 10 and 455 DF,  p-value: 3.582e-07
```

```
summary(lm(tb2$religiousView ~ tb2$kilo + tb2$country + tb2$gender + tb2$age + tb2$degree )) #significa
```

```
##
## Call:
## lm(formula = tb2$religiousView ~ tb2$kilo + tb2$country + tb2$gender +
##     tb2$age + tb2$degree)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -0.93497 -0.29945 -0.01303  0.31567  0.72047
##
## Coefficients:
##                                                  Estimate Std. Error
## (Intercept)                                      0.485898   0.211422
## tb2$kilo                                         0.006538   0.065835
## tb2$country                                     -0.104749   0.058601
## tb2$genderFemale                                -0.043172   0.190360
## tb2$genderMale                                   0.177685   0.193036
## tb2$age                                          0.006887   0.001815
## tb2$degreeBachelor Degree in Science or equivalent -0.196187   0.063956
## tb2$degreeHigh School or equivalent             -0.182804   0.068124
## tb2$degreeM.D. or equivalent                     0.089433   0.178368
## tb2$degreeMaster Degree or equivalent           -0.089009   0.090550
## tb2$degreePh.D. or equivalent                   -0.013430   0.081504
##                                                 t value Pr(>|t|)
## (Intercept)                                       2.298 0.022001 *
## tb2$kilo                                          0.099 0.920937
## tb2$country                                      -1.787 0.074524 .
## tb2$genderFemale                                 -0.227 0.820687
## tb2$genderMale                                    0.920 0.357811
## tb2$age                                           3.794 0.000169 ***
## tb2$degreeBachelor Degree in Science or equivalent  -3.068 0.002287 **
## tb2$degreeHigh School or equivalent              -2.683 0.007553 **
## tb2$degreeM.D. or equivalent                      0.501 0.616335
## tb2$degreeMaster Degree or equivalent            -0.983 0.326142
## tb2$degreePh.D. or equivalent                    -0.165 0.869191
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.4138 on 455 degrees of freedom
## Multiple R-squared:  0.2313, Adjusted R-squared:  0.2144
## F-statistic: 13.69 on 10 and 455 DF,  p-value: < 2.2e-16
```

```
summary(lm(tb2$SciOnLife ~ tb2$kilo + tb2$country + tb2$gender + tb2$age + tb2$degree )) #no effect
```

```
##
## Call:
## lm(formula = tb2$SciOnLife ~ tb2$kilo + tb2$country + tb2$gender +
##     tb2$age + tb2$degree)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -0.92792  0.04956  0.10778  0.11891  0.23102
```

```
##
## Coefficients:
##                                                   Estimate Std. Error
## (Intercept)                                      0.8362684  0.1354130
## tb2$kilo                                         0.0523557  0.0421667
## tb2$country                                     -0.0570500  0.0375334
## tb2$genderFemale                                 0.0481823  0.1219231
## tb2$genderMale                                   0.0747536  0.1236369
## tb2$age                                          0.0002403  0.0011628
## tb2$degreeBachelor Degree in Science or equivalent  0.0076568  0.0409629
## tb2$degreeHigh School or equivalent             -0.0300467  0.0436323
## tb2$degreeM.D. or equivalent                     0.0106936  0.1142420
## tb2$degreeMaster Degree or equivalent            0.0449160  0.0579963
## tb2$degreePh.D. or equivalent                   -0.0632310  0.0522019
##                                                  t value Pr(>|t|)
## (Intercept)                                        6.176 1.46e-09 ***
## tb2$kilo                                           1.242    0.215
## tb2$country                                       -1.520    0.129
## tb2$genderFemale                                   0.395    0.693
## tb2$genderMale                                     0.605    0.546
## tb2$age                                            0.207    0.836
## tb2$degreeBachelor Degree in Science or equivalent   0.187    0.852
## tb2$degreeHigh School or equivalent               -0.689    0.491
## tb2$degreeM.D. or equivalent                       0.094    0.925
## tb2$degreeMaster Degree or equivalent              0.774    0.439
## tb2$degreePh.D. or equivalent                     -1.211    0.226
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.265 on 455 degrees of freedom
## Multiple R-squared:  0.02657,    Adjusted R-squared:  0.00518
## F-statistic: 1.242 on 10 and 455 DF,  p-value: 0.2615
```

```
summary(lm(tb2$dailyLife ~ tb2$kilo + tb2$country + tb2$gender + tb2$age + tb2$degree )) #gender effect
```

```
##
## Call:
## lm(formula = tb2$dailyLife ~ tb2$kilo + tb2$country + tb2$gender +
##     tb2$age + tb2$degree)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -0.9069 -0.1571  0.1628  0.1927  0.6887
##
## Coefficients:
##                                                  Estimate Std. Error
## (Intercept)                                      0.065668   0.174932
## tb2$kilo                                         0.044638   0.054473
## tb2$country                                      0.117550   0.048487
## tb2$genderFemale                                 0.355340   0.157505
## tb2$genderMale                                   0.412733   0.159719
## tb2$age                                          0.001887   0.001502
## tb2$degreeBachelor Degree in Science or equivalent 0.216317   0.052918
## tb2$degreeHigh School or equivalent              0.080848   0.056366
## tb2$degreeM.D. or equivalent                     0.355637   0.147583
```

```
## tb2$degreeMaster Degree or equivalent              0.296546   0.074922
## tb2$degreePh.D. or equivalent                      0.178696   0.067437
##                                                    t value Pr(>|t|)
## (Intercept)                                          0.375  0.70754
## tb2$kilo                                             0.819  0.41296
## tb2$country                                          2.424  0.01572 *
## tb2$genderFemale                                     2.256  0.02454 *
## tb2$genderMale                                       2.584  0.01007 *
## tb2$age                                              1.256  0.20978
## tb2$degreeBachelor Degree in Science or equivalent   4.088 5.15e-05 ***
## tb2$degreeHigh School or equivalent                  1.434  0.15216
## tb2$degreeM.D. or equivalent                         2.410  0.01636 *
## tb2$degreeMaster Degree or equivalent                3.958 8.77e-05 ***
## tb2$degreePh.D. or equivalent                        2.650  0.00833 **
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.3424 on 455 degrees of freedom
## Multiple R-squared:  0.1019, Adjusted R-squared:  0.08212
## F-statistic:  5.16 on 10 and 455 DF,  p-value: 3.582e-07
```

```
summary(lm(tb2$SciEffect ~ tb2$mm + tb2$country + tb2$gender + tb2$age + tb2$degree )) #no effect
```

```
##
## Call:
## lm(formula = tb2$SciEffect ~ tb2$mm + tb2$country + tb2$gender +
##     tb2$age + tb2$degree)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -0.85526 -0.17573  0.04551  0.33237  0.49642
##
## Coefficients:
##                                                     Estimate Std. Error
## (Intercept)                                         0.618041   0.186747
## tb2$mm                                              0.094157   0.036361
## tb2$country                                        -0.086133   0.052115
## tb2$genderFemale                                   -0.033315   0.168755
## tb2$genderMale                                      0.100934   0.170246
## tb2$age                                             0.001405   0.001610
## tb2$degreeBachelor Degree in Science or equivalent  0.046786   0.057246
## tb2$degreeHigh School or equivalent                -0.023111   0.060685
## tb2$degreeM.D. or equivalent                        0.333643   0.158516
## tb2$degreeMaster Degree or equivalent               0.033802   0.080706
## tb2$degreePh.D. or equivalent                       0.001970   0.073009
##                                                    t value Pr(>|t|)
## (Intercept)                                          3.310  0.00101 **
## tb2$mm                                               2.590  0.00992 **
## tb2$country                                         -1.653  0.09907 .
## tb2$genderFemale                                    -0.197  0.84359
## tb2$genderMale                                       0.593  0.55356
## tb2$age                                              0.872  0.38342
## tb2$degreeBachelor Degree in Science or equivalent   0.817  0.41419
## tb2$degreeHigh School or equivalent                 -0.381  0.70351
## tb2$degreeM.D. or equivalent                         2.105  0.03586 *
```

```
## tb2$degreeMaster Degree or equivalent                0.419  0.67553
## tb2$degreePh.D. or equivalent                        0.027  0.97849
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.368 on 455 degrees of freedom
## Multiple R-squared:  0.08835,    Adjusted R-squared:  0.06832
## F-statistic:  4.41 on 10 and 455 DF,  p-value: 6.22e-06
```

```
summary(lm(tb2$SciEffect ~ tb2$inseam + tb2$country + tb2$gender + tb2$age + tb2$degree )) #random
```

```
##
## Call:
## lm(formula = tb2$SciEffect ~ tb2$inseam + tb2$country + tb2$gender +
##     tb2$age + tb2$degree)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -0.86613 -0.20660  0.05787  0.35618  0.48705
##
## Coefficients:
##                                                    Estimate Std. Error
## (Intercept)                                        0.656760   0.187418
## tb2$inseam                                         0.046401   0.047145
## tb2$country                                       -0.093723   0.052346
## tb2$genderFemale                                  -0.059373   0.170022
## tb2$genderMale                                     0.089849   0.171692
## tb2$age                                            0.001230   0.001628
## tb2$degreeBachelor Degree in Science or equivalent 0.069152   0.056854
## tb2$degreeHigh School or equivalent               -0.015323   0.061018
## tb2$degreeM.D. or equivalent                       0.348249   0.159619
## tb2$degreeMaster Degree or equivalent              0.057736   0.080590
## tb2$degreePh.D. or equivalent                      0.024959   0.072916
##                                                   t value Pr(>|t|)
## (Intercept)                                         3.504 0.000503 ***
## tb2$inseam                                          0.984 0.325528
## tb2$country                                        -1.790 0.074046 .
## tb2$genderFemale                                   -0.349 0.727094
## tb2$genderMale                                      0.523 0.601011
## tb2$age                                             0.756 0.450247
## tb2$degreeBachelor Degree in Science or equivalent  1.216 0.224496
## tb2$degreeHigh School or equivalent                -0.251 0.801834
## tb2$degreeM.D. or equivalent                        2.182 0.029639 *
## tb2$degreeMaster Degree or equivalent               0.716 0.474101
## tb2$degreePh.D. or equivalent                       0.342 0.732280
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.3703 on 455 degrees of freedom
## Multiple R-squared:  0.07688,    Adjusted R-squared:  0.0566
## F-statistic:  3.79 on 10 and 455 DF,  p-value: 6.332e-05
```

```
summary(lm(tb2$SciEffect ~ tb2$shaq + tb2$country + tb2$gender + tb2$age + tb2$degree )) #p=0.066 shaq
```

```
##
```

```
## Call:
## lm(formula = tb2$SciEffect ~ tb2$shaq + tb2$country + tb2$gender +
##     tb2$age + tb2$degree)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -0.8562 -0.2026  0.0537  0.3508  0.4998
##
## Coefficients:
##                                                  Estimate Std. Error
## (Intercept)                                      0.622344   0.189948
## tb2$shaq                                         0.066432   0.047419
## tb2$country                                     -0.088281   0.052480
## tb2$genderFemale                                -0.045125   0.169541
## tb2$genderMale                                   0.094077   0.171200
## tb2$age                                          0.001355   0.001619
## tb2$degreeBachelor Degree in Science or equivalent  0.066721   0.056799
## tb2$degreeHigh School or equivalent             -0.015820   0.060909
## tb2$degreeM.D. or equivalent                     0.372459   0.159268
## tb2$degreeMaster Degree or equivalent            0.053811   0.080598
## tb2$degreePh.D. or equivalent                    0.027912   0.072492
##                                                 t value Pr(>|t|)
## (Intercept)                                       3.276  0.00113 **
## tb2$shaq                                          1.401  0.16191
## tb2$country                                      -1.682  0.09322 .
## tb2$genderFemale                                 -0.266  0.79024
## tb2$genderMale                                    0.550  0.58292
## tb2$age                                           0.837  0.40285
## tb2$degreeBachelor Degree in Science or equivalent   1.175  0.24073
## tb2$degreeHigh School or equivalent              -0.260  0.79519
## tb2$degreeM.D. or equivalent                      2.339  0.01979 *
## tb2$degreeMaster Degree or equivalent             0.668  0.50469
## tb2$degreePh.D. or equivalent                     0.385  0.70039
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.3699 on 455 degrees of freedom
## Multiple R-squared:  0.07889,    Adjusted R-squared:  0.05865
## F-statistic: 3.897 on 10 and 455 DF,  p-value: 4.251e-05
```

```
summary(lm(tb2$SciEffect ~ tb2$weather + tb2$country + tb2$gender + tb2$age + tb2$degree )) #no effect
```

```
##
## Call:
## lm(formula = tb2$SciEffect ~ tb2$weather + tb2$country + tb2$gender +
##     tb2$age + tb2$degree)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -0.84448 -0.20627  0.05358  0.35042  0.48925
##
## Coefficients:
##                                                  Estimate Std. Error
## (Intercept)                                      0.648306   0.188103
## tb2$weather                                      0.052611   0.049685
```

```
## tb2$country                                          -0.087675   0.052746
## tb2$genderFemale                                     -0.064326   0.170280
## tb2$genderMale                                        0.078579   0.172597
## tb2$age                                               0.001368   0.001620
## tb2$degreeBachelor Degree in Science or equivalent    0.073303   0.056581
## tb2$degreeHigh School or equivalent                  -0.012918   0.060904
## tb2$degreeM.D. or equivalent                          0.374833   0.159789
## tb2$degreeMaster Degree or equivalent                 0.057080   0.080593
## tb2$degreePh.D. or equivalent                         0.024807   0.072860
##                                                     t value Pr(>|t|)
## (Intercept)                                           3.447 0.000621 ***
## tb2$weather                                           1.059 0.290208
## tb2$country                                          -1.662 0.097156 .
## tb2$genderFemale                                     -0.378 0.705783
## tb2$genderMale                                        0.455 0.649128
## tb2$age                                               0.845 0.398814
## tb2$degreeBachelor Degree in Science or equivalent    1.296 0.195792
## tb2$degreeHigh School or equivalent                  -0.212 0.832118
## tb2$degreeM.D. or equivalent                          2.346 0.019415 *
## tb2$degreeMaster Degree or equivalent                 0.708 0.479151
## tb2$degreePh.D. or equivalent                         0.340 0.733655
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.3703 on 455 degrees of freedom
## Multiple R-squared:  0.07719,    Adjusted R-squared:  0.05691
## F-statistic: 3.806 on 10 and 455 DF,  p-value: 5.957e-05
```

```
f = testTwoFactorTb2("country", "shaq")
```

```
##
##       0 0.5   1
##   0   4   6  55
##   1  69  78 254
```

```
f
```

```
##
##  Fisher's Exact Test for Count Data
##
## data:  tbTwo
## p-value = 0.002417
## alternative hypothesis: two.sided
```

```
f = testTwoFactorTb2( "country", "shaq")
```

```
##
##       0 0.5   1
##   0   4   6  55
##   1  69  78 254
```

```
f
```

```
##
##  Fisher's Exact Test for Count Data
##
## data:  tbTwo
```

```
## p-value = 0.002417
## alternative hypothesis: two.sided
```